cardiofax Q
ELECTROCARDIOGRAPH

ECG-9130K

If you have any comments or suggestions
on this manual, please contact us at:
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0614-004458H

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GENERAL HANDLING PRECAUTIONS

This device is intended for use only by qualified medical personnel.
Use only Nihon Kohden approved products with this device. Use of non-approved products or in a non-approved manner may affect the performance specifications of the device. This includes, but is not limited to, batteries, recording paper, pens, extension cables, electrode leads and AC power.

Please read these precautions thoroughly before attempting to operate the instrument.

1. **To safely and effectively use the instrument, its operation must be fully understood.**

2. **When installing or storing the instrument, take the following precautions:**
   (1) Avoid moisture or contact with water, dust, extreme atmospheric pressure, excessive humidity and temperatures, poorly ventilated areas, and saline or sulphuric air.
   (2) Place the instrument on an even, level floor. Avoid vibration and mechanical shock, even during transport.
   (3) Avoid placing in an area where chemicals are stored or where there is danger of gas leakage.
   (4) The power line source to be applied to the instrument must correspond in frequency and voltage to product specifications, and have sufficient current capacity.
   (5) Choose a room where a proper grounding facility is available.

3. **Before Operation**
   (1) Check that the instrument is in perfect operating order.
   (2) Check that the instrument is grounded properly.
   (3) Check that all cords are connected properly.
   (4) Pay extra attention when the instrument is in combination with other instruments to avoid misdiagnosis or other problems.
   (5) All circuitry used for direct patient connection must be doubly checked.
   (6) Check that battery level is acceptable and battery condition is good when using battery-operated models.

4. **During Operation**
   (1) Both the instrument and the patient must receive continual, careful attention.
   (2) Turn power off or remove electrodes and/or transducers when necessary to assure the patient’s safety.
   (3) Avoid direct contact between the instrument housing and the patient.

5. **To Shutdown After Use**
   (1) Turn power off with all controls returned to their original positions.
   (2) Remove the cords gently; do not use force to remove them.
   (3) Clean the instrument together with all accessories for their next use.

6. **The instrument must receive expert, professional attention for maintenance and repairs. When the instrument is not functioning properly, it should be clearly marked to avoid operation while it is out of order.**

7. **The instrument must not be altered or modified in any way.**

8. **Maintenance and Inspection:**
   (1) The instrument and parts must undergo regular maintenance inspection at least every 6 months.
   (2) If stored for extended periods without being used, make sure prior to operation that the instrument is in perfect operating condition.

(3) Technical information such as parts list, descriptions, calibration instructions or other information is available for qualified user technical personnel upon request from your Nihon Kohden distributor.

9. **When the instrument is used with an electrosurgical instrument, pay careful attention to the application and/or location of electrodes and/or transducers to avoid possible burn to the patient.**

10. **When the instrument is used with a defibrillator, make sure that the instrument is protected against defibrillator discharge. If not, remove patient cables and/or transducers from the instrument to avoid possible damage.**

WARRANTY POLICY

Nihon Kohden Corporation (NKC) shall warrant its products against all defects in materials and workmanship for one year from the date of delivery. However, consumable materials such as recording paper, ink, stylus and battery are excluded from the warranty.

NKC or its authorized agents will repair or replace any products which prove to be defective during the warranty period, provided these products are used as prescribed by the operating instructions given in the operator's and service manuals.

No other party is authorized to make any warranty or assume liability for NKC's products. NKC will not recognize any other warranty, either implied or in writing. In addition, service, technical modification or any other product change performed by someone other than NKC or its authorized agents without prior consent of NKC may be cause for voiding this warranty.

Defective products or parts must be returned to NKC or its authorized agents, along with an explanation of the failure. Shipping costs must be pre-paid.

This warranty does not apply to products that have been modified, disassembled, reinstalled or repaired without Nihon Kohden approval or which have been subjected to neglect or accident, damage due to accident, fire, lightning, vandalism, water or other casualty, improper installation or application, or on which the original identification marks have been removed.

In the USA and Canada other warranty policies may apply.

CAUTION

United States law restricts this device to sale by or on the order of a physician.

EMC RELATED CAUTION

This equipment and/or system complies with the International Standard IEC 60601-1-2 for electromagnetic compatibility for medical electrical equipment and/or system. However, an electromagnetic environment that exceeds the limits or levels stipulated in the IEC 60601-1-2, can cause harmful interference to the equipment and/or system or cause the equipment and/or system to fail to perform its intended function or degrade its intended performance. Therefore, during the operation of the equipment and/or system, if there is any undesired deviation from its intended operational performance, you must avoid, identify and resolve the adverse electromagnetic effect before continuing to use the equipment and/or system.

The following describes some common interference sources and remedial actions:

1. **Strong electromagnetic interference from a nearby emitter source such as an authorized radio station or cellular phone:**
   Install the equipment and/or system at another location if it is interfered with by an emitter source such as an authorized radio station. Keep the emitter source such as cellular phone away from the equipment and/or system.

2. **Radio-frequency interference from other equipment through the AC power supply of the equipment and/or system:**
   Identify the cause of this interference and if possible remove this interference source. If this is not possible, use a different power supply.

3. **Effect of direct or indirect electrostatic discharge:**
   Make sure all users and patients in contact with the equipment and/or system are free from direct or indirect electrostatic energy before using it.

4. **Electromagnetic interference with any radio wave receiver such as radio or television:**
   If the equipment and/or system interferes with any radio wave receiver, locate the equipment and/or system as far as possible from the radio wave receiver.

If the above suggested remedial actions do not solve the problem, consult your Nihon Kohden Corporation subsidiary or distributor for additional suggestions.

NOTE about Waste Electrical and Electronic Equipment (WEEE) directive 2002/96/EEC
For the member states of the European Union only:
The purpose of WEEE directive 2002/96/EEC is, as a first priority, the prevention of waste electrical and electronic equipment (WEEE), and in addition, the reuse, recycling and other forms of recovery of such waste so as to reduce the disposal of waste.
Contact your Nihon Kohden representative for disposal at the end of its working life.

Conventions Used in this Manual and Instrument

Warnings, Cautions and Notes

Warnings, cautions and notes are used in this manual to alert or signal the reader to specific information.

WARNING

A warning alerts the user to possible injury or death associated with the use or misuse of the instrument.

CAUTION

A caution alerts the user to possible injury or problems with the instrument associated with its use or misuse such as instrument malfunction, instrument failure, damage to the instrument, or damage to other property.

NOTE

A note provides specific information, in the form of recommendations, requirements, alternative methods or supplemental information.

Explanations of the Symbols in this Manual and Instrument

The following symbols found in this manual/instrument bear the respective descriptions as given.

Cardiograph

⚠	Attention, consult operator's manual	⊖	Input terminal for analog signal	♥	Type CF applied part
⏚	Equipotential terminal	⊖	Output terminal for analog signal	CE 0086	The CE mark is a protected conformity mark of European Community. The products herewith comply with the requirements of the Medical Device Directive 93/42/EEC.
◇	Serial input/output terminal	⏏	Eject (magazine release button)		
▭	Battery	◇	Memory card slot	🗑	The products marked with this symbol apply to the European WEEE directive 2002/96/EEC and require separate waste collection. For Nihon Kohden products labeled with this symbol, contact your Nihon Kohden representative for disposal at the end of its working life.

Operation panel

∿	Alternating current	❐	Mode	◇	Copy
⊙	"On" only for a part of equipment		Rhythm	▼	Calibration
○	"Off" only for a part of equipment	↺	Paper feed		START/STOP recording
▭	Battery charging		Mark	◎	Automatic control
▮	Battery check		Filter	☜	Manual control

Display

♥	QRS sync mark	⊥	CAL mark

Patient cable

⚠	Attention, consult operator’s manual	♥	Defibrillation-proof Type CF applied part

Section 1 General

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Introduction

The cardiofax Q ECG-9130 is a real time cardiograph with 12-channel recorder. The cardiofax features simple use and a built-in battery.

The cardiograph has the following features:

- Compact and lightweight design is easy to carry. – A4 file size, 4.3 kg including battery

- Up to 12 channel recording on 210 mm recording paper

- An LCD screen allows you to preview 2.8 seconds 12-lead ECG waveforms

- Up to 3,200 ECG data files can be saved in a memory card

Important Safety Information

WARNING

- **Never use the cardiograph in the presence of any flammable anesthetic gas or high-concentration oxygen atmosphere. Failure to follow this warning may cause explosion or fire.**

- **Never use the cardiograph in a high-pressure oxygen medical care tank. Failure to follow this warning may cause explosion or fire.**

Using with a defibrillator

- **Before defibrillation, make sure all persons around the patient are clear of the patient's body and all metal parts of the cardiograph connected to the patient. Failure to follow this warning may cause electrical shock.**
- **Before defibrillation, remove all electrodes and creams, patches, etc. from the patient's chest. When the defibrillator paddle directly contacts these materials, the discharged energy may cause serious electrical burn to the patient.**
- **Use only the specified patient cable. Failure to follow this warning may cause serious electrical burn where the electrode is attached and damage the cardiograph.**
- **Before MRI examination, remove electrodes and transducers from the patient which are connected from this cardiograph. Failure to follow this warning may cause serious electrical burn on the patient due to local heating caused by dielectric electromotive force. For details, refer to the MRI Operator's manual.**
- **When the cardiograph is used with an electrosurgical unit (ESU), firmly attach the entire area of the ESU return plate. Otherwise current from the ESU flows into the electrodes of the cardiograph, causing serious electrical burn where the electrode is attached. For details, refer to the ESU Operator's manual.**

Battery

- **Do not contact the plus (+) terminal and minus (-) terminal.**
- **Do not discard the battery near open flame.**
- **Do not damage, disassemble, drop or give impact to the battery.**
- **Do not leave the battery where infants or small children can reach it.**
- **If battery liquid (diluted sulfuric acid) contacts skin or clothes, immediately wash it off with running water.**

Warning - continued

Patient cable

- Use only the following specified patient cable. When the specified patient cable is connected, the cardiograph is the type CF defibrillation-proof compliance. Failure to follow this warning cause serious electrical burn where the electrode is attached and damage the cardiograph due to discharge energy when defibrillation is performed.

  Patient cable: BJ-901D – IEC standard, 3 mm diameter tip
  BJ-902D – IEC/DIN standard, 4 mm diameter tip
  BJ-903D – IEC/DIN standard, clip
  BA-901D – AHA standard, 3 mm diameter tip
  BA-903D – AHA standard, clip

CAUTION

- Only use the 3-prong power cord provided with the cardiograph. Failure to follow this caution may cause electrical shock to the patient and operator.

- When the provided 3-prong power cord cannot be used, operate the cardiograph on battery power. When another type of power cord (especially 2-prong power cord) is used, this may cause electrical shock to the patient and operator.

- When several medical instruments are used together, ground all instruments at the same one-point ground to protect the patient and operator from electrical shock. Any potential difference between instruments may cause electrical shock to the patient and operator.

- Use Nihon Kohden parts and accessories to assure maximum performance from your cardiograph. When non-specified recording paper or electrodes is used, this may cause incorrect ECG recording result and accelerate deterioration of the cardiograph.

- When connecting an external instrument to the connectors marked with ⚠, ensure that the external instrument complies with the IEC 60601-1 safety standard for medical equipment or CISPR 11 Section Edition 1990-09, Group 1 and Class B standard. When the external instrument does not comply with either of these standards, use a locally available medical use isolation transformer unit between the external instrument and the AC outlet.

Cautions - continued

- **Do not use the output signal from the output connector for a synchronization signal such as the synchronized cardioversion signal. There is a time delay between the input ECG signal and output signal.**

- **This cardiograph provides automatic ECG analysis function. The automatic ECG analysis is performed for acquired ECG waveforms only and does not reflect all conditions of the patient. The results of the analysis may not correspond to the judgment of a physician.**

- **Overall judgement must be performed by the physician, referring to the analysis result, clinical findings, and other examination results. After the physician's overall judgement, the analysis results should be signed or initialed by the physician.**

- **Take care when judging the ECG recording because the 25 Hz EMG filter may cause greater distortion of P-waves and QRS-waves depending on the waveform shape. The characteristics of the EMG filter are similar to a conventional analog filter.**

- **When the cardiograph operates on battery power and large leakage current is input from the connected external instrument, ground the cardiograph or use an isolation transformer for the external instrument. Failure to follow this caution may cause electrical shock to patient and operator.**

- **Use only the KC-010A, KD-010A or KD-104E Cart for the cardiograph. When another cart is used, the cardiograph may fall off or the cart may tip over.**

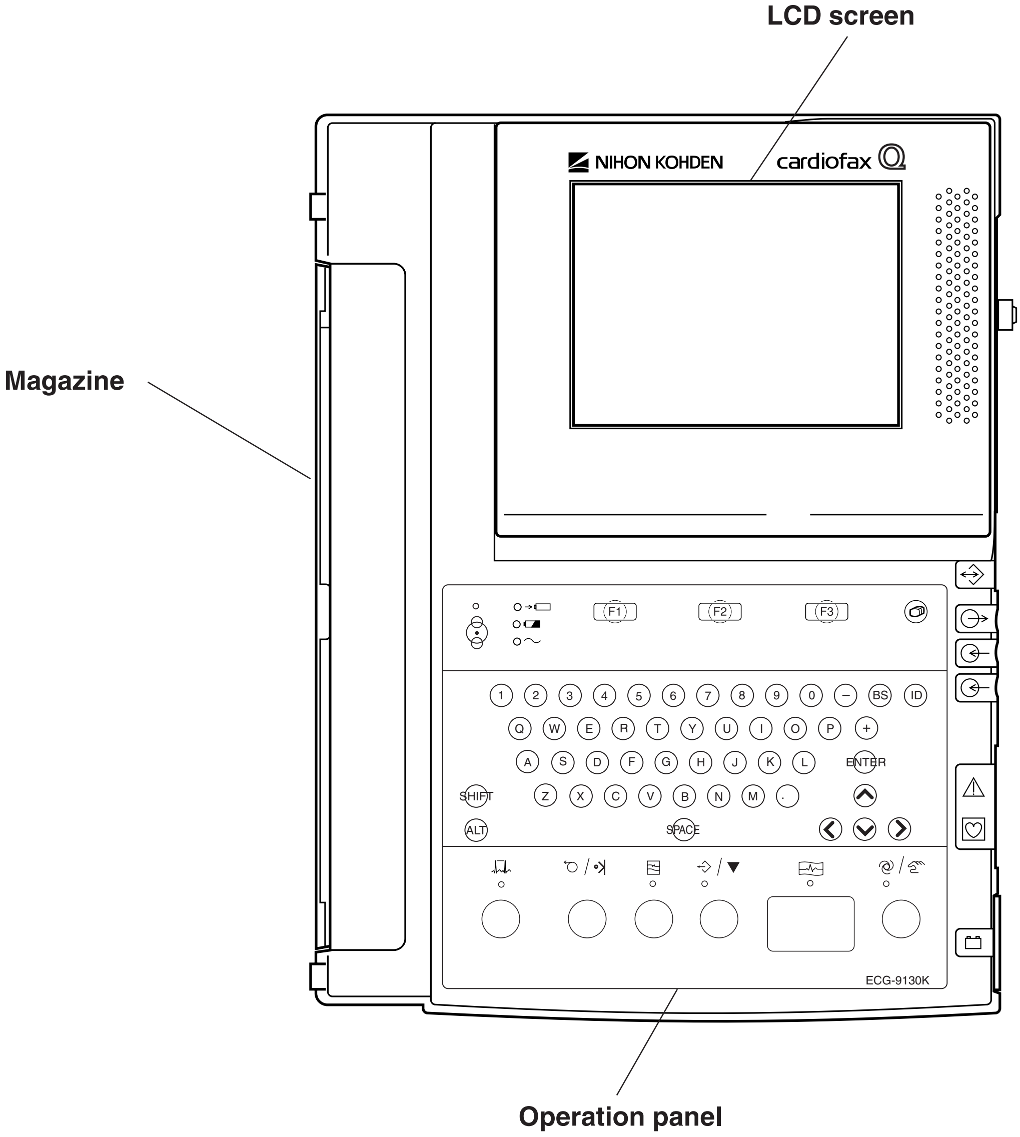
- **Use only the QM-040V memory card.**

- **Never use the cardiograph with its side panel downward. Failure to follow this caution may cause the cardiograph to fall over or cause battery liquid leakage.**

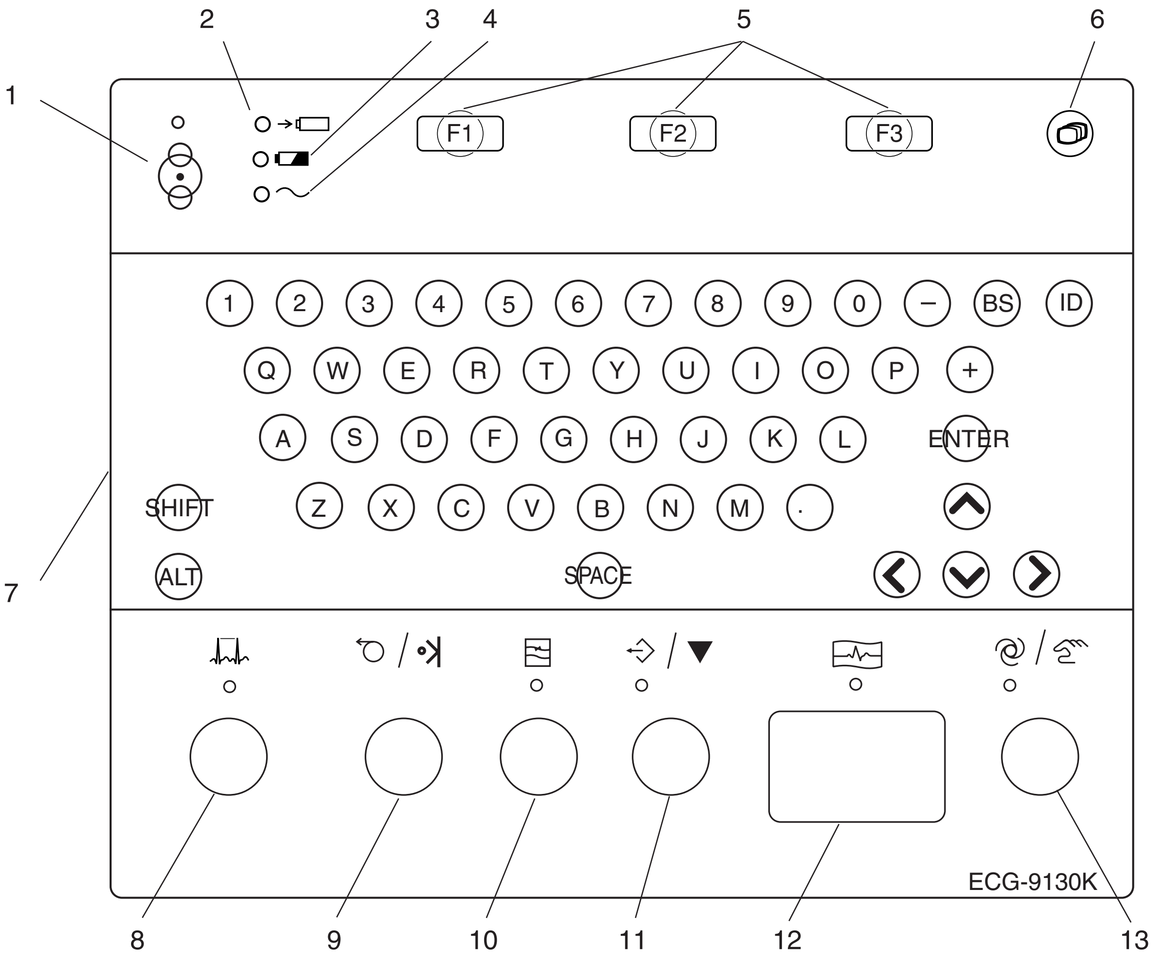
- **Always install the battery even when the cardiograph operates on AC power. Otherwise a sudden power down occurs when an electrode is detached during recording.**

Panel Descriptions

Top View



Operation Panel



Name	**Function**
1. POWER key/lamp	Turns the cardiograph on/off. ● ⏻ : The cardiograph is turned on. ○ ⏻ : The cardiograph is turned off.
2. Battery charge lamp →▭	Indicates the battery charge status. Lit The battery is being charged. Blinking The battery is almost fully charged. Off The battery is fully charged.

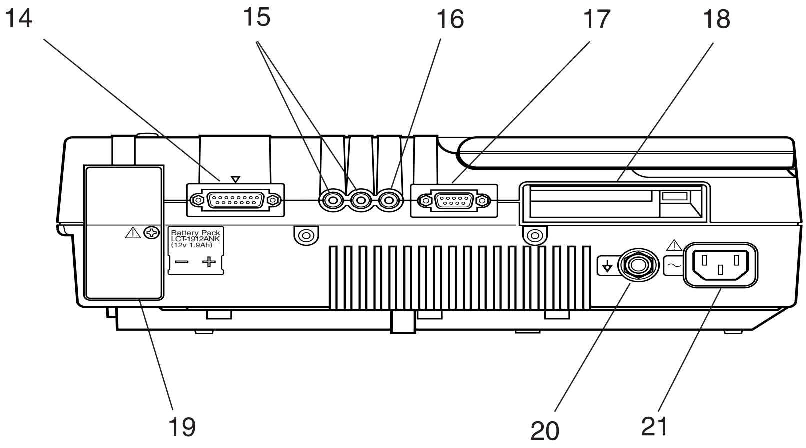
NOTE

After charging is complete, the battery charge lamp blinks. This is because a small current is supplied to the battery (supplementary recharging) in order to prevent self-discharging of the battery. Keep the power cord plugged into the AC outlet.

3. Battery operation lamp ▮	During battery operation, indicates the remaining battery power with the color and lighting state. Blinking in orange indicates that the battery is almost discharged.

4. AC power lamp ~	Lit when AC power is supplied.
5. F1, F2, F3 function keys	Correspond to the functions displayed at the bottom of the screen.
6. MODE key	Calls up the Main menu screen.
7. Keyboard	Use to enter the patient information.
8. RHYTHM key/lamp	Performs the rhythm recording in resting ECG examination. The lamp is lit while waveforms are acquired.
9. FEED/MARK key	Paper feeding: Paper with paper mark (black rectangle mark) at the bottom of the paper: Feeds the recording paper until the next paper mark is detected. Paper without paper mark: Feeds the recording paper continuously while this key is pressed. Refer to “Feeding the paper” in Section 2.
.	Event mark: In the manual recording mode, you can annotate the ECG waveform by pressing this key. An event mark is recorded.
10. FILTER key/lamp	Turns the EMG filter on/off. The lamp is lit when the EMG filter is turned on.
11. COPY/CAL key/lamp	Automatic recording mode and rhythm recording mode: Prints any number of copies of the recording results. During printing, the lamp is lit. Manual recording mode: Records the calibration waveforms. For external input signals, this key is not operative.
12. START/STOP key/lamp	Starts or stops recording. During recording, the lamp is lit.
13. AUTO/MANUAL key/lamp	Selects automatic or manual recording. Lamp on: automatic recording Lamp off: manual recording

Right Side Panel



CAUTION

- **When connecting an external instrument to the connectors marked with ⚠, ensure that the external instrument complies with the IEC 60601-1 safety standard for medical equipment or CISPR 11 Section Edition 1990-09, Group 1 and Class B standard. When the external instrument does not comply with either of these standards, use a locally available medical use isolation transformer unit between the external instrument and the AC outlet**
- **Do not use the output signal from the output connector for a synchronization signal such as the synchronized cardioversion signal. There is a time delay between the input ECG signal and output signal.**

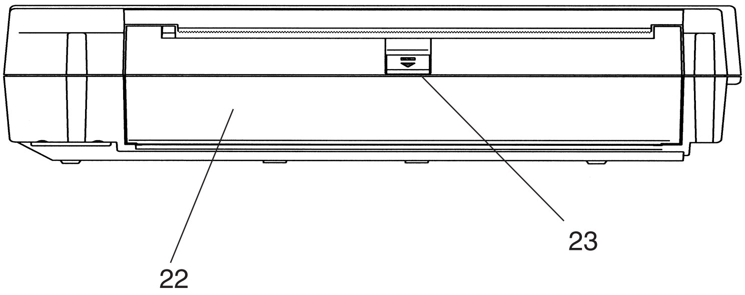
Name	Function
14. Patient input connector	Connects the patient cable.
15. EXT-IN 1, 2 connector	Inputs an analog signal from an external instrument.
16. CRO-OUT connector	Outputs the rhythm lead (lead II) to an external instrument.
17. SIO connector	Connects to other cardiographs and personal computer for RS-232C digital communication.
18. Memory card slot	For a memory card (A memory card is not available in the current version.)
19. Battery compartment	Contains the battery.

CAUTION

Always install the battery even when the cardiograph operates on AC power. Otherwise sudden power down occurs when any electrode is detached during recording.

21. AC power cord socket	Connects the power cord to supply AC power to the cardiograph.
20. Equipotential ground terminal	When the equipotential grounding is required to ensure electrical safety, connect this terminal to the equipotential ground terminal with the ground lead.

Left Side Panel



	Name	Function
22.	Magazine	Contains the recording paper..
23.	Magazine release button	Press this button to open the magazine when setting the recording paper.

Outline of the Functions

ECG recording (Refer to Section 5)

- Automatic recording
  - Real time recording
  - Review recording
  - ECG data transfer (manual)
  - ECG data storage (manual)
  - Copy (manual)
  - Extended arrhythmia rhythm recording
  - Auto start
- Manual recording
  - ECG manual recording
  - External signal recording
- Rhythm recording
  - One minute of one rhythm lead ECG waveform recording
- Periodic recording

ECG data management (Refer to Section 8)

- Transferring an ECG data file
- Recording an ECG data
- Changing an ID number of the ECG data file
- Receiving an ECG data file
- Deleting an ECG data file
- Formatting a memory card

System setting (System Setup screen) (Refer to Section 3)

- Patient information settings
- Recording settings
- Machine settings
- Communication settings
- Manual recording settings
- Auto recording settings
- Periodic recording settings
- Power on settings

System test

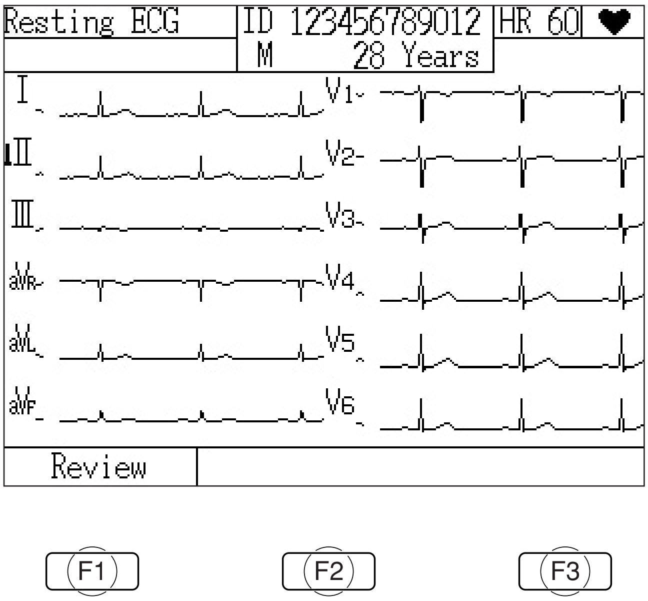
- Recorder
- Thermal head
- Recording resolution setting
- Key
- Memory (single)
- Memory (continuous)
- LCD/LED
- Input unit
- Calibration
- Communication
- CRO/EXT1, 2
- System Setup Initialization

For detailed explanation, refer to the Service manual.

Basic Operation

The cardiograph provides both function keys and dedicated keys on the operation panel.

Press the function key corresponding to the function displayed on the bottom of the screen to perform the desired operation.



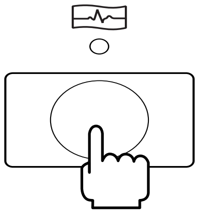
Resting ECG

ID 123456789012

HR 60

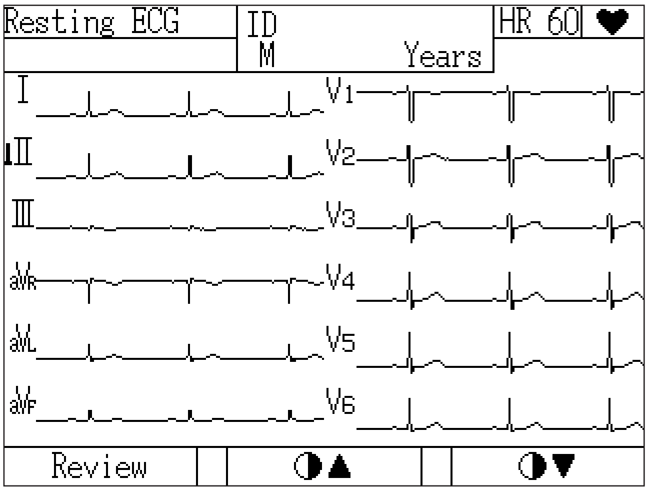
M 28 Years

Press the key on the operation panel to perform the desired operation.



Switching Screens

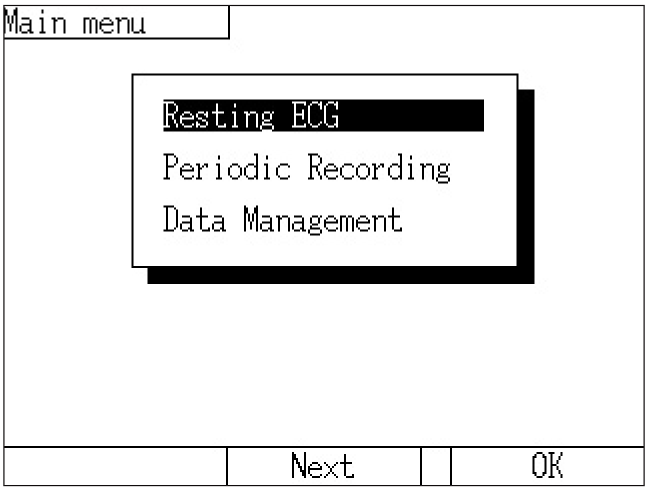
When the cardiograph is turned on, the Resting ECG screen appears.



To perform the automatic ECG waveform recording, press the START/STOP key on the operation panel.

To switch to another screen to select the operation item that you want:

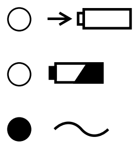
1. Press the MODE key to call up the Main menu screen.



2. Press the F2 “Next” function key to select a desired item. The selected item is highlighted.

3. Press the F3 “OK” function key to call up the desired screen.

AC Operation and Battery Operation



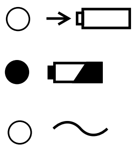
AC power lamp on

AC power operation:

When AC power is supplied, the cardiograph operates on AC power and the AC power lamp is lit.

CAUTION

Always install the battery even when the cardiograph operates on AC power. Otherwise sudden power down occurs when any electrode is detached during recording.



Battery operation lamp on

Battery power operation:

When AC power is not supplied, the cardiograph automatically switches to battery power operation and the battery operation lamp is lit to indicate the remaining battery power. The cardiograph can operate at least 30 minutes with a new fully charged battery.

NOTE

- **When the battery is almost discharged and the power is turned on, the "Charge Battery" message appears, the battery operation lamp blinks in orange, an alarm sounds and the cardiograph immediately turns the power off.**
- ***Automatic power off*: To prevent unwanted battery consumption in battery operation, the cardiograph automatically turns the power off when the "Fail" message (electrode detachment) is displayed on the screen and there is no key operation for approximately three minutes. In this case, temporarily changed settings are lost. If this happens, turn the power back on to use the cardiograph continuously.**

Battery operation time

NOTE

Remaining battery power changes depending on the surrounding temperature and quality of recording waveform.

Battery operation lamp	Available recording time
Lit in green	Between 20 to 30 minutes
Lit in green and orange	Between 10 to 20 minutes
Lit in orange	Less than 10 minutes
Blinking in orange	Power will be lost in within one minute. Recharge the battery immediately or operate on AC power.

Section 2 Preparation

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Selecting a Suitable Location

Put the cardiograph in a suitable location according to the following warnings and cautions.

WARNING

- **Never use the cardiograph in the presence of any flammable anesthetic gas or high-concentration oxygen atmosphere. Failure to follow this warning may cause explosion or fire.**
- **Never use the cardiograph in a high-pressure oxygen medical care tank. Failure to follow this warning may cause explosion or fire.**
- **Before connecting an external instrument to the cardiograph, ensure that the external instrument complies with the IEC 60601-1 safety standard for medical equipment or CISPR 11 Section Edition 1990-09, Group 1 and Class B standard. When the external instrument does not comply with either of these standards, use a locally available medical use isolation transformer unit between the external instrument and the AC outlet.**

CAUTION

- **The cardiograph should not share the power line with any instrument which consumes a lot of power, such as an X-ray instrument, because it may cause artifact.**
- **Do not locate the cardiograph where it can be sprinkled with liquids.**
- **Avoid direct sprinkling, spray or moist air from a nebulizer or humidifier.**
- **Do not expose the cardiograph to direct sunlight.**
- **Do not use the cardiograph near a heater or humidifier**
- **Use only the KC-010A, KD-010A, or KD-104E Cart for the cardiograph. When another cart is used, the cardiograph may fall off or the cart may tip over.**
- **Do not use the cardiograph with its side panel downward. Failure to follow this caution may cause the cardiograph to fall over or cause battery liquid leakage.**

- Make sure that there is more than 5 cm of space between the cardiograph and the wall for adequate ventilation so that the operating temperature does not exceed 40 °C (104 ° F).
- Make sure there is no excessive interference from a cellular phone.
- Arrange the cardiograph and other equipment to reduce electric radiation noise from other equipment which has a CRT display as much as possible.

Connecting the Power Cord

When operating the cardiograph on AC power or charging the battery, supply AC power.

3-prong AC Outlet
Connect the provided power cord to the AC power cord socket on the right side panel and plug the cord into a 3-prong AC outlet.

2-prong AC Outlet
Use the following procedures only when a 3-prong AC outlet is not available and a 2-contact AC outlet is not legally prohibited.

WARNING

Never use a water pipe or gas pipe as a ground because it is not properly grounded and there is a hazard of explosion.

---

1. Connect the equipotential ground terminal on the right side panel to a ground post with a ground lead.

2. Connect the power cord to the AC power cord socket on the right side panel and plug the cord into an AC outlet.

Equipotential Grounding

CAUTION

Equipotential grounding may be required for patient safety. Consult with a qualified biomedical engineer.

When equipotential grounding is required to ensure patient safety, connect the equipotential ground terminal on the right side panel to the equipotential ground terminal on the wall with a ground lead.

Necessity of Equipotential Grounding

When several ME instruments are used, avoid potential difference between instruments. Potential difference between instruments may cause current to flow to the patient connected to the instruments, resulting in electrical shock (micro shock).
Never use any medical equipment in patient treatment without proper grounding.

Perform equipotential grounding where equipotential grounding is required, such as in the operating room, ICU room, CCU room, cardiac catheterization room and x-ray room.

Battery

Safety Information for Battery

WARNING

- **Do not contact the plus (+) terminal and minus (-) terminal.**
- **Do not discard the battery near open flame.**
- **Do not damage, disassemble, drop or give impact to the battery.**
- **Do not leave the battery where infants or small children can reach it.**
- **If battery liquid (diluted sulfuric acid) contacts skin or clothes, immediately wash it off with running water.**

CAUTION

Usage

- **Use only the LCT-1912ANK battery.**
- **Contact your NK distributor or a specialist with electrical knowledge when installing the battery.**
- **Do not insert or remove the battery when the power is turned on.**
- **Operate the cardiograph at temperatures lower than 40°C (104°F) on battery power. A fully recharged battery allows 30 minutes continuous recording when the ambient operating temperature is 25°C (77°F). The operating time may be less than 30 minutes depending on the ambient temperature and ECG waveform quality.**
- **If the operating time is less than 15 minutes, the battery may be deteriorated. Replace it with a new one. Typical battery life time is about one year.**
- **Always install the battery even when the cardiograph operates on AC power. Otherwise sudden power down occurs when any electrode is detached during recording.**

Charging

- **Charge the battery at least six hours for full charging.**
- **The battery cannot be charged during cardiograph operation (The AC power lamp and POWER lamp light).**
- **The battery life is shortened when the battery is charged at high ambient temperatures. Charge the battery at temperatures below 30°C (86°F).**
- **Do not place the cardiograph upright with the front panel downward. This may cause leakage of fluid from the battery.**
- **Do not charge a deteriorated battery. This may damage the cardiograph.**

Caution - continued

Storage

- **Do not leave the battery in a discharged condition. Otherwise the battery will become over-discharged and unable to be charged.**
- **The battery self-discharges when it is not used for a long period. Charge the battery every six months. When storing the battery at temperatures 30°C (86°F) or more, charge the battery every three months.**
- **Store the battery within the specified temperature range.**

Disposal

- **Before disposing of the battery, check with your local solid waste officials about proper disposal.**

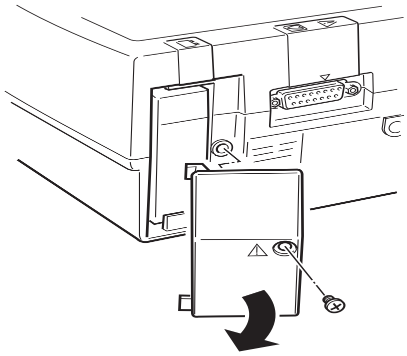
Inserting a Battery

CAUTION

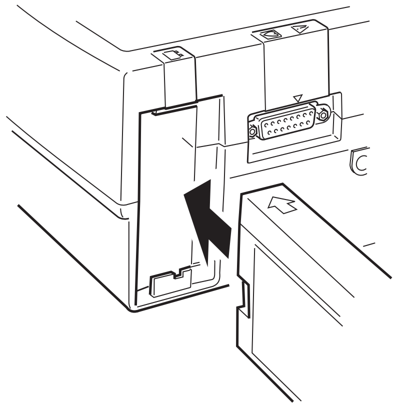
Use only the LCT-1912ANK battery.

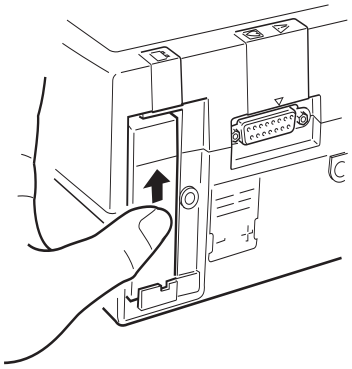
The cardiograph is shipped from the factory without a battery installed. Follow the procedure below to insert a battery into the cardiograph before use.

1. Remove the M3 binding top screw from the battery cover and remove the buttery cover by turning it as shown in the figure.



2. Insert the battery with the arrow marked side up.



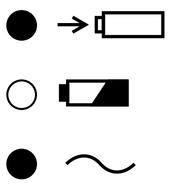


To remove the battery, push up the battery with your finger as shown in figure.

3. Reattach the battery cover and secure it with the screw.

Charging the Battery

The battery can be charged when AC power is supplied to the cardiograph and the POWER key is not pressed. The battery charge time is at least 6 hours. A new fully charged battery allows at least 30 minutes continuous recording.



To charge the battery:
When the cardiograph is not used, connect the cardiograph to a wall AC outlet. The AC power lamp and battery charge lamp light.

When the cardiograph operates on AC power, press the POWER key to turn the power off.

When the cardiograph operates on battery power,

1. Press the POWER key to turn the power off.
2. Connect the cardiograph to a wall AC outlet. The AC power lamp and battery charge lamp light.

Battery charge lamp

Lit	The battery is being charged.
Blinking	The battery is almost fully charged.
Off	The battery is fully charged

NOTE

- **After charging is complete, the battery charge lamp will blink. This is because a small current is supplied to the battery (supplementary recharging) in order to prevent self-discharging of the battery. Keep the power cord plugged into the AC outlet.**
- **When the battery charge lamp does not blink even after a six-hour recharging, the battery life may be expired. Replace the battery with a new one.**

For battery operation time, refer to “AC Operation and Batter Operation” in Section 1 “General”.

Mounting the Cardiograph on the Cart

The three types of optional carts are available.

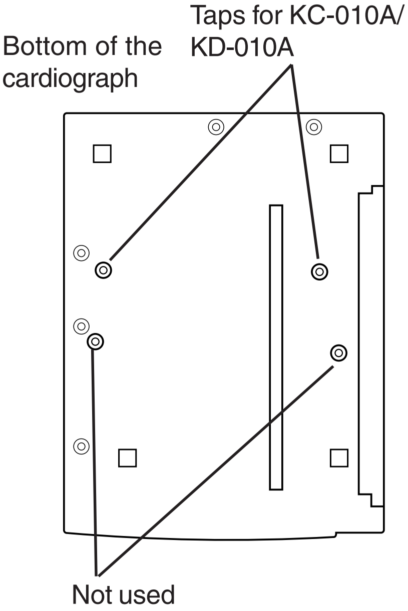
CAUTION

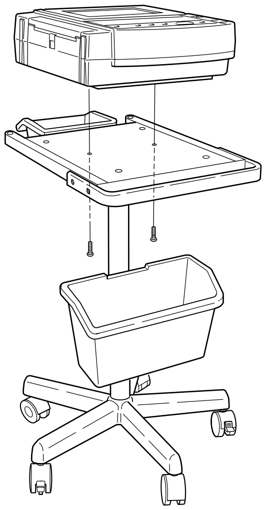
Use only the KC-010A, KD -010A or KD-104E Cart for the cardiograph. When another cart is used, the cardiograph may fall off or the cart may tip over.

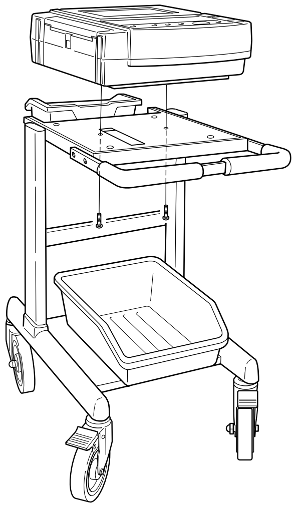
Mounting the Cardiograph on the KC-010A or KD-010A Cart

1. Place the cardiograph on the cart so that the four rubber feet fit into the holes on the cart.

2. Secure the cardiograph with the two fixing screws and spacers that are included in with the cart.




KC-010A


KD-010A

Setting the Recording Paper

CAUTION

Type of recording paper

- **Use only the 210 mm width Nihon Kohden specified recording paper. When a narrower width recording paper is used and the paper detection circuit detects it, the thermal head is activated. The thermal head may be damaged where there is no recording paper and the rubber paper feed roller may get burned.**

Handling the recording paper

Storage

- **Prolonged storage under conditions such as high temperatures, excessive humidity, direct sunlight, and fluorescent light will cause fading of the colored surface. Avoid high temperatures exceeding 50°C (122°F) and excessive humidity. Store the recording paper in a cool, dry and dark place if possible.**

Usage

- **Organic solvents and plastics may develop color on the white surface or cause the recording paper to fade.**
  Examples of color-developing materials containing organic solvents:
    Adhesives, paste, felt-tip pens, and semi-dry diazo paper.
  Examples of color-fading materials made of soft vinyl chloride:
    Document cases, albums, and desk pads.
  Examples of color-fading materials containing plastics:
    Erasers, adhesive tapes, and some of fluorescent pens.
- **The paper cutter in the recording paper compartment is sharp. When setting the recording paper, take special care not to cut your finger.**
- **When pasting the recording paper, use paste with a starch base, PVA base, arabic gum base paste, CMC base synthetic paste, or paper bond.**
- **Do not apply high pressure to the recording paper. Rubbing or scratching the surface with a hard object develops color.**
- **Clean the thermal head with the thermal head cleaner before setting the recording paper. A dirty thermal head degrades printing quality.**
- **Do not use recording paper which is contaminated with ECG electrolyte cream (Cardio cream) or saline solution because the recording paper will fade by a chloride and the contaminated thermal head may cause missing dots. If the thermal head gets contaminated, clean it with the thermal head cleaner pen.**

Caution - continued

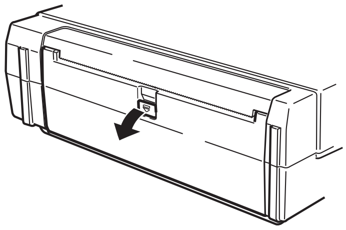
- **Do not touch the thermal head with your fingers. If accidentally touched, clean the thermal head with the thermal head cleaner pen.**
- **Follow the procedure to set the recording paper. Otherwise, the recording paper may not feed normally or the feeding motor may stop operation.**

Recording Paper

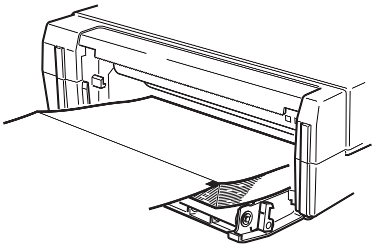
Model	Type	Length	Paper mark	Grid	Paper location
FQW210-3-140	Z-FOLD	30 m	Every 140 mm	No	In the cardiograph
FQW210-10-295*	Z-FOLD	100 m	Every 295 mm	No	On the KD-010A cart
FQW210-30-295*	Z-FOLD	300 m	Every 295 mm	No	On the KD-010A cart
FQS210-30-295*	Z-FOLD	300 m	Every 295 mm	Yes	On the KD-010A cart
RQW210-3	Roll	30 m	No	Yes	In the cardiograph
RQS210-3	Roll	30 m	No	Yes	In the cardiograph

* Use the DI-002A paper tray to set the recording paper on the KD-010A cart.

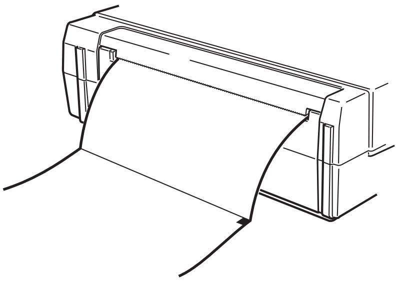
Setting the Z-fold Type Recording Paper



1. Press down the magazine release button to open the magazine.



2. Insert the recording paper into the magazine.

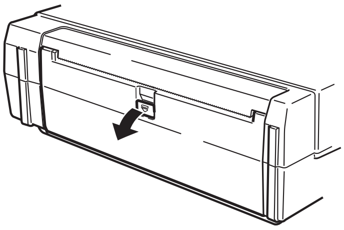


3. Pull out the first page of recording paper and align the recording paper with the paper guide for correct setting.
4. Press the center of the magazine to close it.

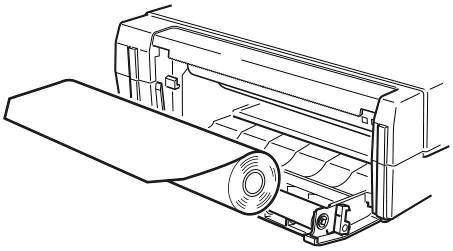
NOTE

When recording paper is not aligned with the paper guide, skewing may occur.

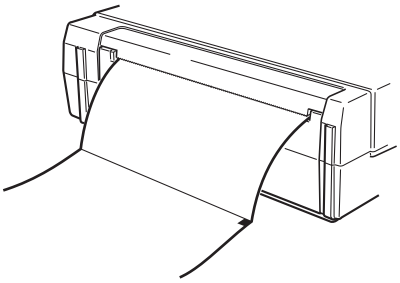
Setting the Roll Type Recording Paper



1. Press down the magazine release button to open the magazine.



2. Set the recording paper in the hollow of the magazine.



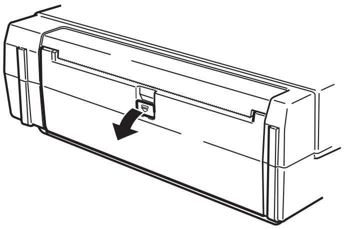
3. Pull out the first page of recording paper and align the recording paper with the paper guide for correct setting.

4. Press the center of the magazine to close it.

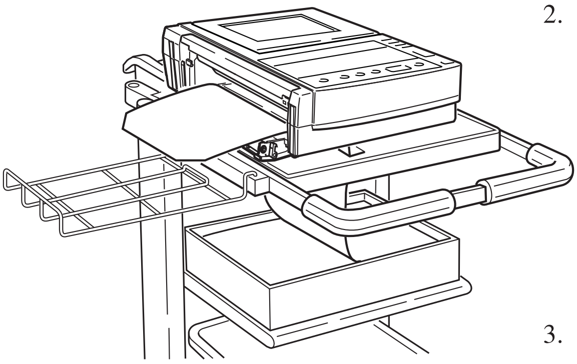
NOTE

When recording paper is not aligned with the paper guide, skewing may occur.

Setting the Z-fold Type Recording Paper on the Cart

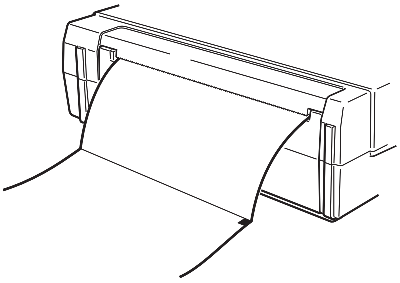


1. Press down the magazine release button to open the magazine.



2. Set the carton of recording paper on the paper tray (DI-002A, option for the KD-010A cart).

3. Pull the first page of the recording paper through the opening of the magazine

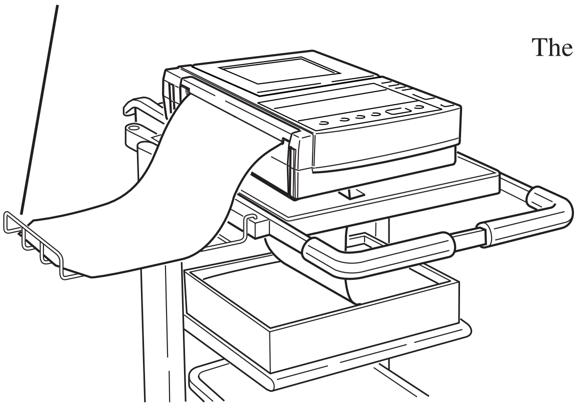


4. Align the recording paper with the paper guide for correct setting.

5. Press the center of the magazine to close it.

NOTE

When recording paper is not aligned with the paper guide, skewing may occur.



The paper rack holds the printed recording paper.

Changing the Settings for the Recording Paper

Set the following four items according to the paper. Refer to “Recording settings” in Section 3 “Changing settings before measurement”.

- Paper length
- Recording paper thickness
- Recording paper with que mark
- Grid recording

Out of Paper Indication

When there is no recording paper or the magazine is not properly closed, an alarm sounds, the START/STOP lamp blinks and the recording is automatically stopped. Set the recording paper correctly in the cardiograph.

Feeding the Paper

The paper can be fed by pressing the FEED/MARK key before or after recording. The paper is fed according to the following settings.

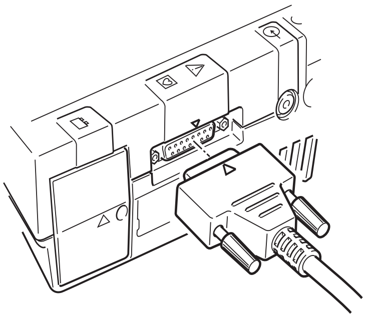
	"Recording paper cue mark" setting in the System setup mode	
Paper type	with cue mark	without cue mark
With the paper mark	The paper feeds to the next paper mark.	The paper feeds continuously while the FEED/MARK key is pressed.
Without the paper mark	The paper feeds to the next page.	

Connecting the Patient Cable

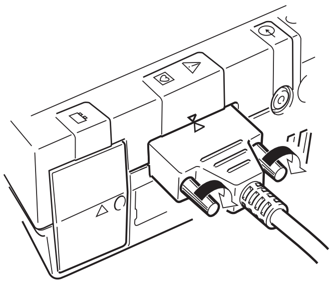
WARNING

Use only the following specified patient cable. When the specified patient cable is connected, the cardiograph is the type CF defibrillation-proof compliance. Failure to follow this warning causes serious electrical burn where the electrode is attached and damage the cardiograph due to discharge energy when defibrillation is performed.

Patient cable: **BJ-901D – IEC standard, 3 mm diameter tip**
BJ-902D – IEC/DIN standard, 4 mm diameter tip
BJ-903D – IEC/DIN standard, clip
BA-901D – AHA standard, 3 mm diameter tip
BA-903D – AHA standard, clip



1. Connect the patient cable with the mark side up to the patient input connector on the right side panel.



2. Secure the patient cable connector to the cardiograph with the screws on the patient cable connector.

Memory Card

Precautions When using the Memory Card

CAUTION

- **Use only the QM-040V memory card.**

Handling

- **Do not touch any part of the connector. Static energy may damage the memory or saved data.**
- **Do not discard the memory card near open flame.**
- **Do not bend the card. It may damage the memory.**
- **Do not damage, disassemble, drop or give impact to the memory card.**
- **Do not get the card wet. It may damage the memory.**
- **Do not expose the card to high temperature or high humidity. The card may deform.**

Storage:	
Temperature	**-20 to 65°C (-4 to 149°F)**
Humidity	**25 to 95 % RH (non condensing)**
Operation:	
Temperature	**10 to 40°C (50 to 104°F)**
Humidity	**25 to 95 % RH (non condensing)**

Operation

- **Do not press the memory card eject button or turn the power off while data is being written to or read from the card. Otherwise, the memory or saved data may be damaged.**
- **Format the memory card only in an ECG-9130K or ECG-9320A/K cardiograph. Memory cards formatted in other ECG models cannot be used in this cardiograph.**

Disposal

- **Before disposing of the memory card, check with your local solid waste officials about proper disposal.**

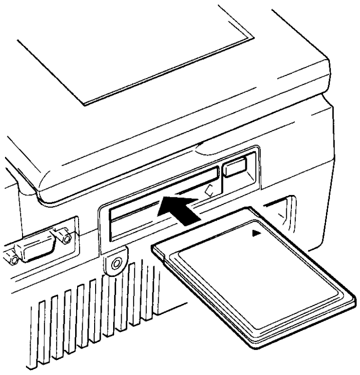
Inserting and Removing the Memory Card

CAUTION

Use only the QM-040V memory.

To insert the memory card:

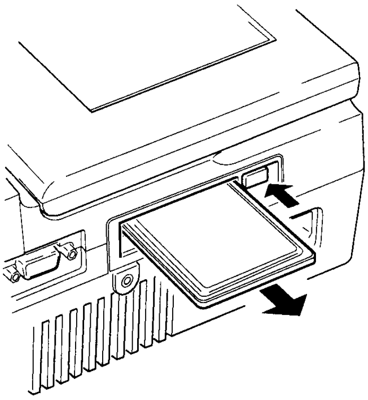
1. Insert the memory card into the memory card slot with the QM-040V labeled side up.



2. Push the memory card in until the eject button comes out.

To remove the memory card:

1. Press the memory card eject button.



2. Pull the card out.

Formatting the Memory Card

CAUTION

Format the memory card before the first use.

NOTE

- **A memory card formatted on an ECG-9130K cardiograph can save up to three ECG data files which have the same ID number or no ID number. If a 4th ECG data file which has the same ID number or no ID number is saved in the memory card, the oldest file which has the same ID number or no ID number is automatically deleted.**
- **A memory card formatted by the ECG-9320A/K cardiograph can save any number of files which have the same ID number or no ID number.**

To format the memory card, refer to “Formatting a memory card” in Section 8.

Power On Procedure

The cardiograph can operate on AC power or battery power.

CAUTION

- **Only use the 3-prong power cord provided with the cardiograph. Failure to follow this caution may cause electrical shock to the patient and operator.**
- **When the provided 3-prong power cord cannot be used, operate the cardiograph on battery power. When another type of power cord (especially 2-prong power cord) is used, this may cause electrical shock to the patient and operator.**

---

1. Before turning the power on, check the following items.
   If there is any damage or the cardiograph is suspected to be faulty as a result of checking, attach an “Unusable” or “Repair request” label to the cardiograph and contact your NK distributor or representative.

   Check items before turning the power on

   Overview:
   - Cardiograph is not dirty, damaged or in contact with liquid.
   - No peeling or tear in the operation panel.
   - No key is broken.
   - Electrodes are clean and not damaged.
   - Power cord is not damaged.
   - Cable hanger is not damaged.
   - Paper magazine is not damaged.
   - Battery is installed.

   Connection and setting:
   - Power cord is securely connected.
   - Cardiograph is securely connected to an external instrument.
   - Patient cable is securely connected to the cardiograph.
   - Recording paper is properly set.
   - Battery is fully charged.

   Accessories:
   - Enough electrolyte cream
   - Enough recording paper
   - Enough disinfected or sterilized dry electrodes
   - Patient cable is not frayed or damaged
   - No crack in the rubber of suction electrode.
   - New and used electrodes are not used together.

2. Press the POWER key on the operation panel to turn the cardiograph on. The self-check program runs. If there is an error, the system information and error history are automatically printed. Refer to the service manual. If the self check program detects a fatal error, the power is automatically turned off. Contact your Nihon Kohden distributor or representative.

3. After turning the power on, check the following items.

Check items after power on

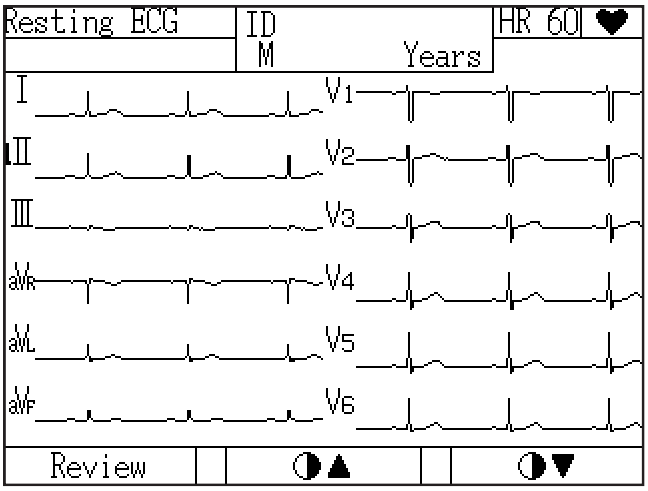
- No fire, smoke or smell.
- No electrical shock when touching the cardiograph.
- Cardiograph is not too hot.
- Cardiograph does not affect surrounding equipment.
- All operation indicators are lit.
- AC power lamp or battery power lamp is lit normally.
- There is no error message on the screen or malfunction.
- Screen display is correct (such as brightness, contrast, no distortion, normal color).
- All keys on the operation panel operate correctly.
- All settings are correct.
- Calibration waveform is properly recorded. Refer to “System Test” in the Service manual.
  Amplifier of calibration waveform is correct.
  No noise on the calibration waveform.
- Recording is correct (paper feeding without skewing or catching, intensity, no jamming, date and time).
- There is no error message or malfunction for key operation.
- External equipment operates correctly.

4. When the cardiograph is used for the first time, set the followings. Refer to Section 3 “Changing settings before measurement”.

Patient information settings:	Height and Weight units, Blood pressure unit
Recording settings:	AC filter
Machine settings:	Date and time, Date display format, Time display format

Adjusting the Screen Contrast

Only when the power is turned on, the contrast can be changed. Adjust the contrast with the F2 or F3 function key.



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Section 3 Changing Settings Before Measurement (System Setup Screen)

General 3.1
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    Patient Information Settings 3.2
    Recording Settings 3.4
    Machine Settings 3.6
    Communication Settings 3.8
    Manual Recording Settings 3.8
    Auto Recording Settings 3.9
    Periodic Recording Settings 3.10
    Power on Settings 3.11
Changing Settings and Printing 3.12
    Setting Procedure 3.12
    Printing the List of All System Settings 3.13
    Entering the Hospital Name 3.14
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    Entering the Telephone Number 3.16

General

Before measurement, you can change the following recording and other settings. Changed settings are saved after the power is turned off.

- Patient information settings
- Recording settings
- Machine settings
- Communication settings
- Manual recording settings
- Auto recording settings
- Periodic recording settings
- Power on settings

List of Settings

The factory default settings are underlined.

Patient Information Settings

Item	Description	Settings	No.
ID	Select “On” to display this item on the Patient data screen.	On Off	101 102
Sex	Select “On” to display this item on the Patient data screen. **CAUTION** **When this item is set to “Off”, “Sex” is not displayed and the ECG analysis is performed with the patient as male.**	On Off	103 104
Age or birth date	Select the displayed item on the Patient data screen to enter the age. You can enter age either by birth date or age in years. **CAUTION** **When this item is set to “Off”, neither “Age” nor “Birth date” is displayed and ECG analysis is performed with the patient as 35 years old.**	Age Birth date Off	105 106 107
Height	Select “On” to display this item on the Patient data screen.	On Off	108 109
Weight	Select “On” to display this item on the Patient data screen.	On Off	110 111
Sys/Dia	Select “On” to display this item on the Patient data screen.	On Off	112 113
Data auto delete	Select “On” to automatically delete the patient data when the Patient data screen is called up for the next patient.	On Off	114 115
Backspace delete 1 char or group	Select the function of the back space key on the keyboard of the operation panel. Refer to “Entering the patient information” in Section 4.	group single character	116 117

Item	Description	Settings	No.
Name	Select “On” to display this item on the Patient data screen.	On Off	118 119
Medication 1	Select “On” to display this item on the Patient data screen.	On Off	120 121
Medication 2	Select “On” to display this item on the Patient data screen.	On Off	122 123
Department	Select “On” to display this item on the Patient data screen.	On Off	124 125
Room Number	Select “On” to display this item on the Patient data screen.	On Off	126 127
Technician	Select “On” to display this item on the Patient data screen.	On Off	128 129
Requesting physician	Select “On” to display this item on the Patient data screen.	On Off	130 131
Height and Weight units	Select the height and weight units.	cm/kg in/lb	132 133
Blood pressure units	Select the blood pressure unit	mmHg kPa	134 135
Auto ID increment	Select “On” to increment the patient ID when the automatic recording starts. When the “Fail” message (electrode detachment) is displayed, the patient ID is automatically incremented.	On Off	136 137

Recording Settings

Item	Description	Settings	No.
Paper length	Set this item to match the one page length of the recording paper.	140 mm 295 mm	201 202
Recording paper cue mark	Select “with cue mark” when the recording paper has paper marks at the bottom of the paper.	with cue mark without cue mark	203 204
Recording paper thickness	Select “Thick” for a thick recording paper.	Normal Thick	205 206
Grid recording	Prints a grid (vertical and horizontal lines as a scale) on plain paper.	On Off	207 208
High speed recording	Paper speed for automatic recording and copy recording. When this item is set to “On”, recording time is shortened by half.	On (50 mm/s) Off (25 mm/s)	209 210
Slow paper speed	Slow paper speed for manual recording and external recording.	12.5 mm/s 10 mm/s 5 mm	211 212 213
Baseline drift suppression	Baseline drift suppression prevents the baseline from drifting by locking it into one position at the start of recording. **CAUTION** **When this item is set to “Strong”, distortion may occur in the ST segment with a decrease of heart rate when heart rate is less than 50. For bradycardia, set this item to “Weak”.** **The “Weak” setting has characteristics conforming to the AHA recommendations.**	Strong Weak Off	214 215 216
High cut filter	This is active only when the EMG filter is turned off.	75 Hz 100 Hz 150 Hz	217 218 219

Item	Description	Settings	No.
EMG suppression	EMG filter frequency **CAUTION** **Take care when judging the ECG recording because the 25 Hz EMG filter may cause greater distortion of P-waves and QRS-waves depending on the waveform shape. The characteristics of the EMG filter are similar to those of a conventional analog filter.**	25 Hz 35 Hz	220 221
AC filter	Set this to match your AC power line frequency.	50 Hz 60 Hz Off	222 223 224
Lead mode selection	Select the ECG lead recording order.	Standard 12 leads Cabrera leads	226 227

Machine Settings

Item	Description	Settings	No.
QRS sync/pen sound selection	QRS sync sound: Turns the QRS synchronized sound on. Pen sound: Makes a scratching sound like a stylus on paper. Off: No sound is made for ECG.	QRS sync sound Pen sound Off	301 302 303
QRS sync sound volume		1 (min) 2 3 4 (max)	304 305 306 307
Alarm sound volume	**CAUTION** **When this item is set to “0”, there is no alarm sound.**	0 (off) 1 (min) 2 3 4 (max)	308 309 310 311 312
Chime sound volume		0 (off) 1 (min) 2 3 4 (max)	313 314 315 316 317
Date and time	After entering “318”, enter a 4 digit number from “1980” to “2079” for the year.	Year	318
	After entering “319”, enter a 2 digit number for the months and 2 digit number for the date.	Month and Date	319
	After entering “320”, enter a 4 digit number for the time in 24 hour system format. The 12 or 24 hour system for displaying and printing is set in “Time display format”.	Hour and Minute	320
	Enter “322” and press the START/STOP key after changing the date and time. The internal clock starts counting from 0 seconds.	Set key	322
Date display format	Selects the date display and printing format.	yyyy/mm/dd yyyy-mmm-dd mmm-dd-yyyy dd-mmm-yyyy	325 326 327 328
Time display formats	Select the time display and printing format.	12 hour day 24 hour day	329 330

Item	Description	Settings	No.
Wave display format	Select the waveform display format on the screen. Each lead sync QRS: Beats for each of 12 leads 6 leads ×2: 2.8 seconds of each 12 lead ECG waveforms is displayed in 2 sequences of 6 channel	Each lead sync QRS 6 leads ×2	331 332
Hospital	Enter your hospital name with up to 20 characters.		333
Display language	Select the language for recording. **NOTE** **When you install your language into the cardiograph, check the descriptions on the screen and ECG finding list printed on the recording paper before use. For the descriptions on the screen, you can compare them with the text that your distributor provides. For the ECG finding list, you can compare them with the list in the User's Guide "ECAPS 12C ECG Interpretation Program". If there is any missing or incorrect translation, contact your NK distributor to correct it.**	English Local language	334 335

Communication Settings

Item	Description	Settings	No.
Modem initialize command	Enter the modem initialization command with up to 31 characters. Refer to the modem operation manual.	ATV1Q0X4S0=0DT	401
Telephone number	Enter the phone number with up to 20 numeric characters when using the modem.		402
Direct/modem connection	Select direct communication or modem	Direct	403
		Modem	404
Baud rate (bps)	Select the baud rate to match the baud rate of the connected instrument.	2400	405
		4800	406
		9600	407
		19200	408
		38400	409
		57600	410
		115200	411
After receiving	Select the operation of the connected cardiograph or personal computer after it receives the ECG data file. **NOTE** **If the connected cardiograph or personal computer cannot save the received ECG data file, you must select "Print".**	Save	412
		Print	413
		Save and Print	414

Manual Recording Settings

Item	Description	Settings	No.
Recording channels	Select the number of recording channels for manual and periodic recording.	3 ch	501
		3 ch + rhythm	502
		6 ch	503
		12 ch	504

Auto Recording Settings

Item	Description	Settings	No.
Waveform recording format	Select the recording format.	6 ch (12 lead) 3 ch (12 lead) 3 ch (12 lead) + rhythm 3 ch rhythm average 6 ch (12 lead) 50 mm/s 6 ch (12 lead) 50 mm/s F	509 510 511 512 513 537
Extended recording	Select "On" to record the rhythm lead (lead II) when an arrhythmia is detected. 60 seconds of the rhythm lead is recorded in 6 traces on one or more pages. The number of pages depends on the one page length of the recording paper.	On: rhythm (full page) Off	524 526
Auto start	Select "On" to automatically start recording.	On Off	527 528
Auto feed after recording	Select "On" to automatically feed the paper to the paper mark after recording.	On Off	529 530
Auto file save	Select "On" to save the ECG waveform after recording.	On Off	531 532
Auto file save check	Select "On" to display the confirmation screen when saving files.	On Off	533 534
Auto feed after stop recording	Select "On" to feed the recording paper to the next paper mark when the recording is stopped by pressing the START/STOP key. This function is not available in the manual recording mode.	On Off	535 536
Include reason	Select "On" to record the reason for the finding.	On Off	607 608
QTc calculation method	Select a method to calculate QTc.	ECAPS bazett	612 613

QT interval varies according to the heart rate. QTc interval is a corrected value based on a heart rate of 60 bpm.

ECAPS:

$$\text{QTc interval (ms)} = \text{QT interval (ms)} + \frac{(1000 - \text{R-R interval (ms)})}{7}$$

bazett:

$$\text{QTc interval (ms)} = \frac{\text{QT interval (ms)}}{\sqrt{\text{R-R interval (s)}}}$$

Item	Description	Settings	No.
Pacing detection sense	Select the pacing detection sensitivity. If noise is misdetected as a pacing pulse, select "Low".	High Low	614 615
Report print out	Select "On" to record the ECG analysis result on the paper in the automatic recording mode. **NOTE** **Even when "Off" is selected, set the recording paper. Otherwise, ECG analysis cannot be performed.**	On Off	616 617
Analysis text data transfer	Select "On" to transfer the ECG analysis data (measurement data, ECAPS code, ECG findings and overall judgement) as text data. When "Off" is selected, the ECG data file is transferred.	On Off	618 619

Periodic Recording Settings

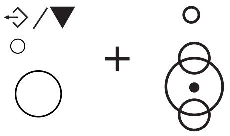
Item	Description	Settings	No.
Starting leads	Select the starting lead group	Limb Chest	701 702
Time settings: Interval	Set the interval between periodic recording. After entering "735", enter the minutes.	1-60min (1min)	735
Additional slow speed recording	Select "On" to record the selected rhythm leads during periodic recording.	On Off	737 738
Auto gain	Select "On" to use the auto gain and auto position function during periodic recording.	On Off	739 740

Power on Settings

Item	Description	Settings	No.
EMG suppression	Select "On" to turn on the EMG filter when the power is turned on.	On	901
		Off	902
Sex	Select the patient's sex when the power is turned on.	M	903
		F	904
		Space	905
Back Light Auto Off	Select whether or not the backlight is automatically turned off in AC operation. Select "On" to automatically turn off the backlight when the unit is operated on AC power.	On	921
		Off	922
Auto power off	Select "On" to turn off the power of the cardiograph automatically in battery operation.	On	925
		Off	926
System set printing	Prints the list of the system settings.		999

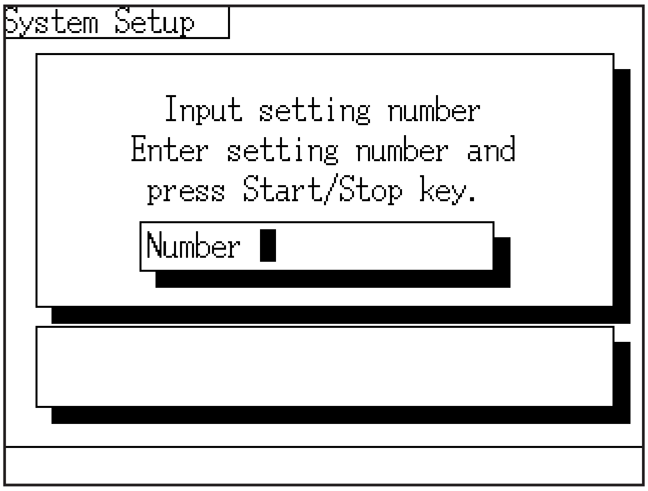
Changing Settings and Printing

Calling Up the System Setup Screen



1. If the power is on, turn it off.

2. Press POWER key and COPY/CAL key together. Hold the COPY/CAL key until the cardiograph begins to print the list of settings. The System Setup screen is displayed.



System Setup

Input setting number
Enter setting number and
press Start/Stop key.

Number

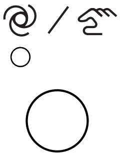
To stop printing, press the START/STOP key.

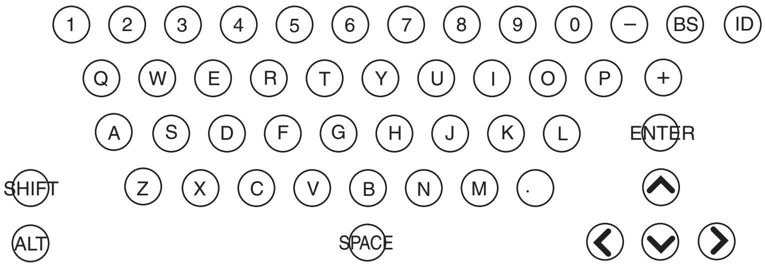
NOTE

If you continue to hold the COPY/CAL key while the list of settings is printed, the system information "Error 05" is printed at the last of printing. The "Error 05" means the COPY/CAL key was pressed for too long. This is normal.

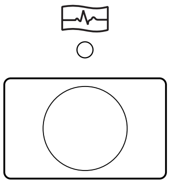
Changing the Settings

1. From the System Setup screen, enter the numbers of the desired setting with the keyboard. Refer to the printed setting list for the current status of all settings. Every setting has a 3 digit number to change the setting.

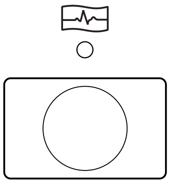




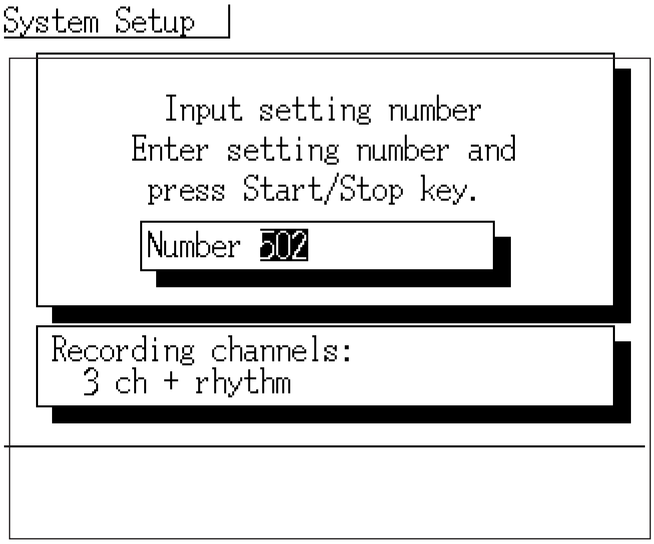
To delete the entered number, press the AUTO/MANUAL key.



2. Press the START/STOP key to save the changed setting. The changed setting appears on the screen. If you entered an unspecified number, an alarm occurs.



3. Repeat steps 2 to 3 to change another setting item.



System Setup

Input setting number
Enter setting number and
press Start/Stop key.

Number 502

Recording channels:
3 ch + rhythm

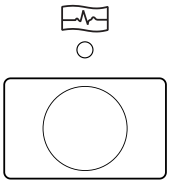
To print the list of System Setup settings, enter “999”, then press the START/STOP key

4. Press the POWER key to restart the cardiograph with the new settings.

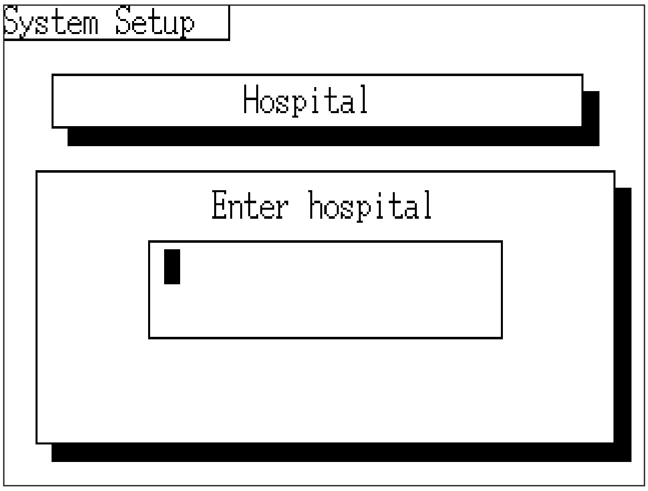
Printing the List of All System Settings

From the System Setup screen, enter “999”, then press the START/STOP key.

Entering the Hospital Name

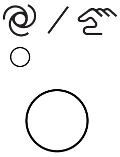


1. Call up the System Setup screen.
2. Enter “333” with the keyboard and press the START/STOP key. The Hospital name setting window appears.

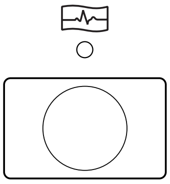


3. Enter the hospital name with the keyboard and press the ENTER key. Up to 20 characters are available.

   To delete the character before the cursor, press the BS (Back space) on the keyboard.

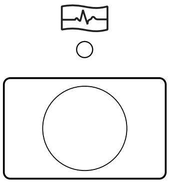


   To cancel entering, delete each character by BS function key. When all characters are deleted, press the AUTO/MANUAL key.



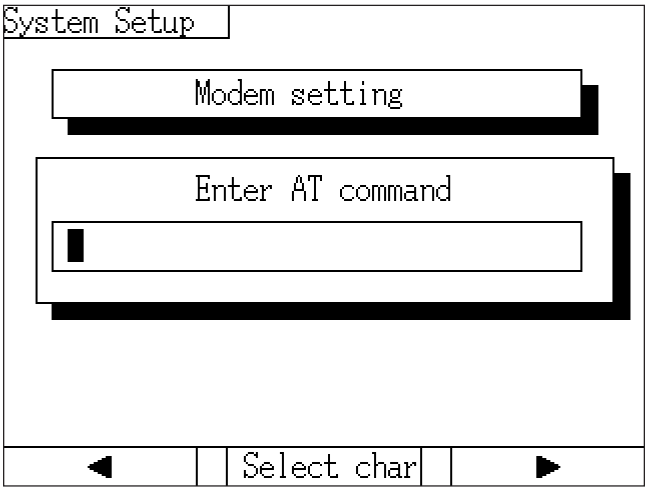
4. Press the START/STOP key to save the setting.

Entering the Modem Initialize Command



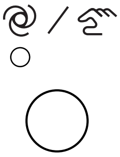
1. Call up the System Setup screen.

2. Enter “401” with the keyboard and press the START/STOP key. The Modem setting window appears.

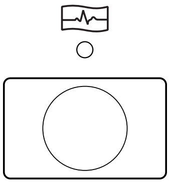


3. Enter the modem initialization command with the keyboard and press the ENTER key. Up to 31 characters are available.
The default setting is “ATV1Q0X4S0=0DT”.

To delete the character before the cursor, press the BS (Back space) on the keyboard.

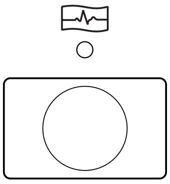


To cancel entering, delete each character by BS function key. When all characters are deleted, press the AUTO/MANUAL key.

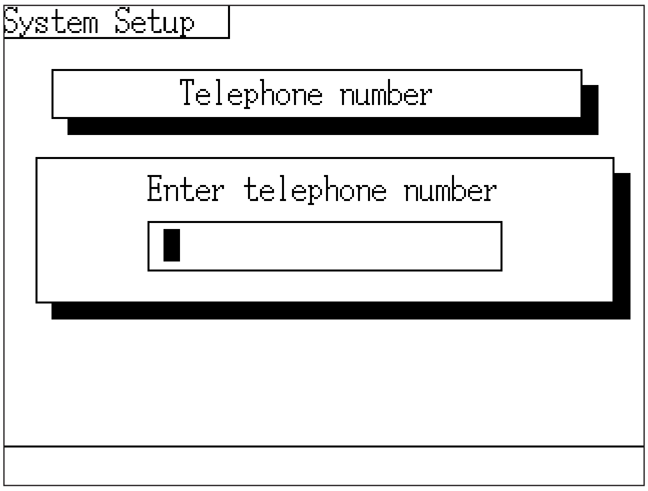


4. Press the START/STOP key to save the setting.

Entering the Telephone Number



1. Call up the System Setup screen.
2. Enter “402” with the keyboard and press the START/STOP key. The Telephone number window appears.



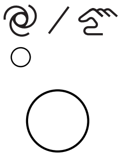
System Setup

Telephone number

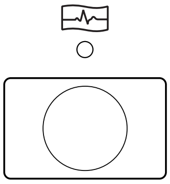
Enter telephone number

3. Enter the phone number with the keyboard and press the ENTER key. Up to 20 numeric characters are available.

   To delete each number, press the BS (Back space) key.



   To cancel entering, delete each number by pressing the BS. When all numbers are deleted, press the AUTO/MANUAL key.



4. Press the START/STOP key to save the setting.

Section 4 Attaching the Electrode

Attaching the Electrodes 4.1
    Attaching the Limb Electrodes 4.1
    Attaching the Chest Electrodes 4.2
Patient Cable Tip Color Coding 4.3
Lead Connection 4.4
Error Indication When the Electrode Is Not Attached Firmly 4.5
    Message on the Screen 4.5
    Indication on the Paper 4.5
    Countermeasure 4.6
Entering the Patient Information 4.7
    General 4.7
    Entering Procedure 4.8

Attaching the Electrodes

CAUTION

- **Do not use new and old electrodes together, or re-usable and disposable electrodes together (such as clip electrodes, suction electrodes, and disposable electrodes). If different types are used together, it may cause a high polarization voltage and prevent displaying and recording of the ECG waveforms.**
- **Always replace all the electrodes with new ones at the same time.**
- **When using an ESU and defibrillator with the cardiograph, use silver chloride disposable electrodes.**
- **Use only clean and undamaged electrodes with no scratches on the surface. Electrodes with a deteriorated surface may cause high contact impedance and distorted ECG waveforms.**
- **Do not contact electrodes or cardiograph connectors with any other ground or conductive object in the room, such as metal bedposts.**

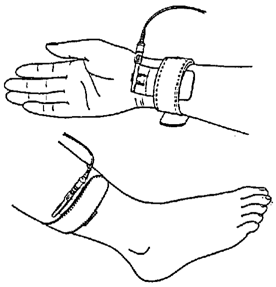
Attaching the Limb Electrodes

Attach four limb electrodes to muscular, not bony, areas on the extremities using the following steps:

1. Clean the skin with a cotton moistened with alcohol to remove oil.

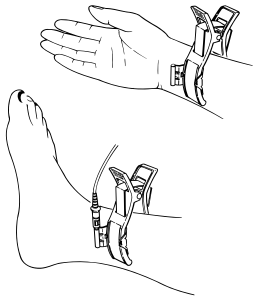
2. Thinly apply electrolyte cream (CardioCream) on the cleaned electrode sites.
   R (RA): Right arm
   L (LA): Left arm
   RF (RL): Right leg
   F (LL): Left leg

3. Apply a small amount of electrolyte cream also on the contact surface of the electrodes.



4. When limb electrodes and limb electrode straps are used:
   1) Attach the limb electrodes to the cleaned skin site.

   2) Fasten the limb electrodes with the limb straps. Be sure that the straps fit snugly, but not too tight.



   When the ECG clip-on electrodes are used:
   Clip the electrode site with the ECG clip-on electrode.

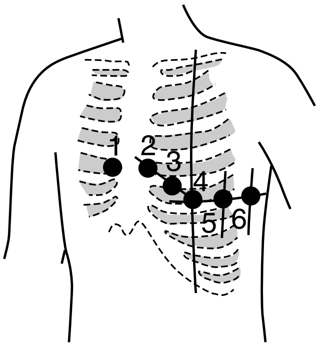
Attaching the Chest Electrodes

1. Clean the skin electrodes with a cotton moistened with alcohol to remove oil.

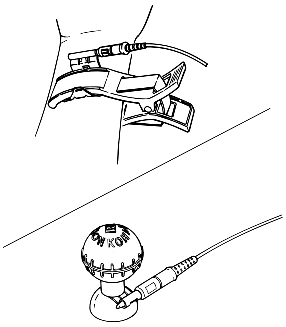
2. Thinly apply electrolyte cream (CardioCream) on the cleaned skin sites.

3. Attach the six electrodes to the cleaned skin site. Take care not to let the electrodes come in contact with each other.

4. Thinly apply CardioCream on the electrode surface and squeeze the rubber ball to make the electrode adhere by vacuum suction.
   - C1 (V1): Fourth intercostal space at the right border of the sternum
   - C2 (V2): Fourth intercostal space at the left border of the sternum
   - C3 (V3): Halfway between C2 (V2) and C4 (V4)
   - C4 (V4): Fifth intercostal space on left midclavicular line
   - C5 (V5): Left anterior axial line at the horizontal level of C4 (V4)
   - C6 (V6): Left midaxillary line at the horizontal level of C4 (V4)



Patient Cable Tip Color Coding



BJ-901D (IEC standard, Tip: 3 mm diameter) / BJ-902D (IEC/DIN standard, Tip: 4 mm diameter) / BJ-903D (IEC/DIN standard, clip)

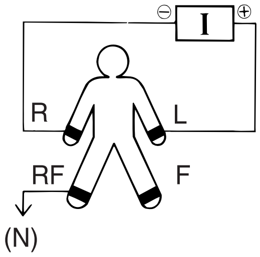
Symbol in lead	Color (tip/lead)
R	Red/Brown
L	Yellow/Brown
F	Green/Brown
N (RF)	Black/Brown
C1	Red/White
C2	Yellow/White
C3	Green/White
C4	Brown/White
C5	Black/White
C6	Violet/White

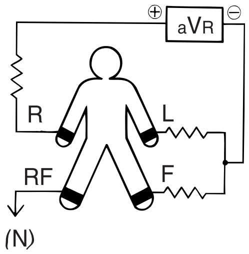
BA-901D (AHA requirement; Tip: 3 mm diameter) / BA-903D (AHA requirement, clip)

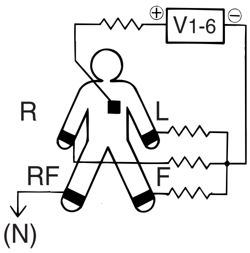
Symbol in lead	Color (tip/lead)
RA	White/Brown
LA	Black/Brown
RL	Green/Brown
LL	Red/Brown
V1	Red/White
V2	Yellow/White
V3	Green/White
V4	Blue/White
V5	Orange/White
V6	Violet/White

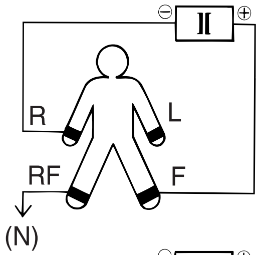
Lead Connection

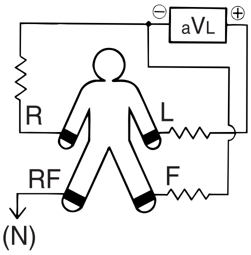
IEC Standard

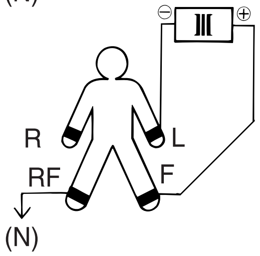


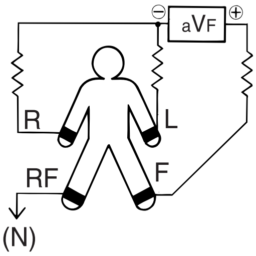




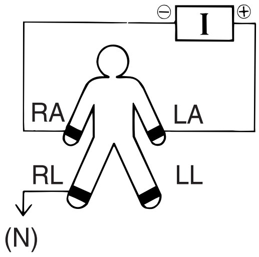


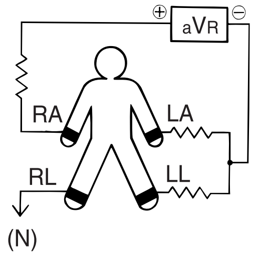


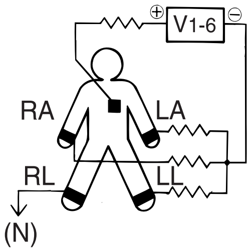


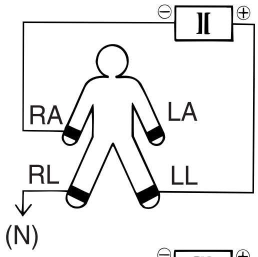


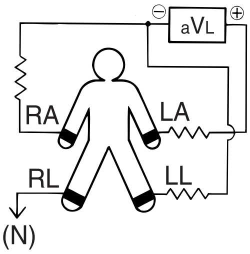
AHA Requirement

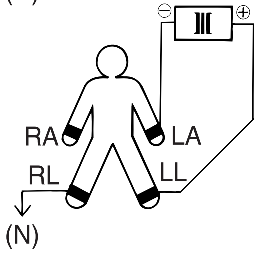


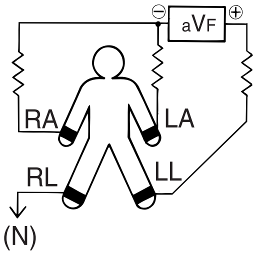












Error Indication When the Electrode Is Not Attached Firmly

Message on the Screen

The cardiograph always checks electrode attachment status. When electrode detachment or large polarization voltage is detected, the corresponding electrode detachment or noise message is displayed.

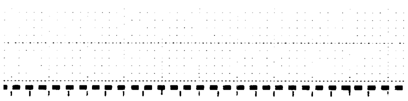
Message on screen	Possible cause
Limb electrode name	The displayed limb electrode is detached.
Fail Limb	• Two or more limb electrodes from the R, L or F electrode is detached. • The RF elected is detached. • No electrode is attached to the patient.
Fail 1, 2, 3, 4, 5 or 6	The chest electrode corresponding to the number is detached.
Noise	Artifact is detected.

NOTE

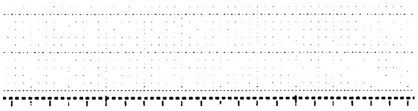
- **If a limb electrode is detached, the chest electrode detachment message is not displayed.**
- **If electrode detachment is detected, the “Noise” message is not displayed.**
- **A flat baseline is recorded for leads with a detached electrode.**

Indication on the Paper

During recording, the following line is recorded on the paper when an electrode detachment or artifact is detected.



Electrode Detachment



Noise

Countermeasure

♦ Electrode Detachment

Check for detached electrodes corresponding to the message and reattach the electrodes.

♦ Large polarization voltage

If the message is still displayed after reattaching the electrode, it is probably due to a large skin voltage (polarization voltage). Use a cotton moistened with alcohol to clean the skin where the electrode is attached.

If electrode detachment is not detected, check for a large polarization voltage.
A large polarization voltage is generated by the following reasons:

- New and old electrodes, or re-usable and disposable electrodes are used together (such as clip electrodes, suction electrodes, and disposable electrodes). If different types are used together, it may cause a large polarization voltage and prevent displaying and recording of the ECG waveforms.
- After defibrillation, wait at least 5 seconds until the ECG waveforms are stable before recording the ECG waveforms.
- The ECG waveforms can be recorded even if the electrode detachment message is displayed, but these are incorrect waveforms. Record the ECG waveforms after removing the cause of the message.
- If a limb electrode is detached, the chest electrode detachment message is not displayed. Check the chest electrode attachment after removing the cause of the message.

When the cause of the message cannot be found, the patient cable may be faulty. If any abnormality is found, refer to Section 8 “Troubleshooting” to take proper action. If there is any damage or the cardiograph is suspected to be faulty as a result of checking, attach an “Unusable” or “Repair request” label to the cardiograph and contact your Nihon Kohden distributor or representative.

Entering the Patient Information

General

You can enter the following patient information in the Patient Data screen. The available patient data can be selected in the Patient information settings. Refer to Section 3 “Changing the settings before measurement”.

CAUTION

When the patient sex and age is not entered, ECG analysis is performed with the patient as male and 35 years old.

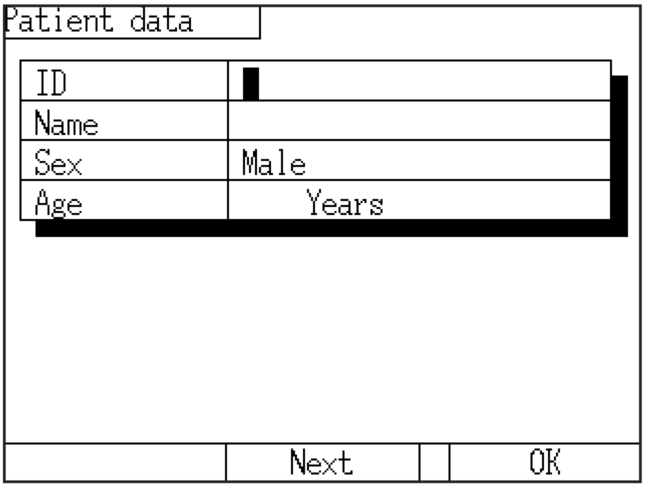
Available patient data

- ID: Up to 12 alphanumeric characters
- Sex: male, female
- Age: Up to 3 numeric characters
- Birth of date:
- Height: Up to 3 numeric characters
- Weight: Up to 3 numeric characters
- Systolic pressure: Up to 3 numeric characters
- Diastolic pressure: Up to 3 numeric characters
- Name: Up to 20 alphanumeric characters
- Medication 1: Up to 22 alphanumeric characters
- Medication 2: Up to 22 alphanumeric characters
- Department: Up to 22 alphanumeric characters
- Room Number: Up to 10 alphanumeric characters
- Technician: Up to 20 alphanumeric characters
- Requesting physician: Up to 20 alphanumeric characters

The height, weight and blood pressure units can be selected in the Patient information settings.

Entering Information

1. Press the ID key. The Patient data screen is displayed. Even when this screen is displayed, the cardiograph acquires the ECG waveforms. You can start recording soon after the patient information is entered.



Patient data

ID	
Name	
Sex	Male
Age	Years

NOTE

When only "ID", "Sex" and "Age" of the Patient information settings in the System setup screen are selected for the entry item, the Patient data screen is not displayed. "ID", "Sex" and "Age" can be entered on the resting ECG waveform screen".

Depending on the number of the items, the Patient data screen has one or two pages.

2. Enter the patient information with the keyboard and press the ENTER key. The cursor moves to the next item.

   To move the currsor to the desired item, press the F2 "Next" function key, or the up or down arrow key.

   To move the cursor to a different charecter, press the left or right arrow key.

   To delete one character, press the BS key. One character before the cursor is deleted.

   To delete all characters in an item, move the cursor to the first character, then press the BS key.

   To copy the previous patient information, set "Data auto delete" of the patient information settings in the System setup screen to "Off" .

When the ID number is separated with “-”, you can delete the characters before “-”, with the BS key.

To delete groups of characters between hyphens in the ID number, set “Backspace delete 1 char or group” of the Patient information settings to “group” and press the BS key.

Example:
123-456-789 ■

123-459 ■ The BS key is pressed.

123■ The BS key is pressed again.

3. When all items are entered, press the ID key. The Resting ECG screen is displayed.

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Section 5 Recording Resting ECG Waveforms

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General

You can automatically or manually record the resting ECG waveform. When the power is turned on, automatic recording mode is automatically selected.

Automatic Recording Mode

In automatic recording mode, the ECG analysis is automatically performed. After ECG waveforms are recorded, the ECG analysis result is automatically printed. There are two types of automatic recording modes. One is real time recording mode, the other is review recording mode. In the review recording mode, you can verify the ECG waveform displayed on the screen before start of the recording for clear ECG recording and accurate ECG analysis. During automatic recording, when an arrhythmia is detected, the 60 seconds of rhythm lead (lead II) can be recorded automatically (extended arrhythmia rhythm recording).

After recording, you can save the 10 seconds of 12 lead ECG waveforms, analysis result and patient information as an ECG data file in a memory card and transfer the ECG data file to another cardiograph or personal computer. Up to 3,200 ECG data files can be saved in the memory card. If the memory card has a previously saved ECG data file which has the same ID number, you can record previously saved ECG data to compare with the current ECG data. You can make one or more copies of the recording results by pressing the COPY/CAL key until the next recording is started.

Manual Recording Mode

In manual recording mode, you can manually change the recording settings (paper speed, sensitivity, and EMG filter on/off) during recording to assure the recording result. You can also annotate the ECG waveforms with the event mark by pressing the FEED/MARK key.

Rhythm Recording Mode

Before or after automatic or manual ECG recording, you can record 60 seconds of the rhythm lead (lead II) in 3 traces for 2 pages

Settings

For recording settings and other settings, refer to Section 3 “Changing settings before measurement (System Setup screen)”.

Caution When Artifact Superimposes on the ECG Waveform

CAUTION

During recording, if more than 3 mm artifact is superimposed on the ECG waveform, immediately stop the recording and remove the cause of the artifact. Refer to Section 8 “Troubleshooting”. Failure to follow this caution causes overheating and damage to the cardiograph.

If the ECG recording continues in this condition, the power unit in the cardiograph generates high frequency noise which causes the cardiograph to heat up. When the cardiograph heats up, an alarm sound occurs and the START/STOP lamp blinks. The recording cannot be performed until the cardiograph cools down.

Flow of Resting ECG Waveform Recording

Following is the basic procedure for recording resting ECG waveform.

1. Turn the power on.

2. Select automatic or manual recording mode.

   Automatic recording:

   1) Enter the patient information. Refer to “Entering the patient information” in Section 4.

   2) Select the review recording mode with the F1 “Review” function key, if necessary.

   3) Press the START/STOP key.

   To print a copy of the recording results, press the COPY/CAL key.

   When “Auto file save” is set to “On”, after automatic recording the ECG waveform, analysis result and patient information are automatically saved in a memory card as an ECG data file and you can manually transfer the ECG data file.

   Manual recording:

   1) Press the F1 function key to select the first lead group.

   2) Press the START/STOP key.

   3) Press the F1 function key to select the next lead group.

   4) Repeat steps 3) to record all lead groups.

   5) Press the START/STOP key to stop recording.

   Rhythm recording

   1) Press the RHYTHM key.

Notes for Accurate Measurement

Before Starting the Recording

1. Before pressing the START/STOP key, confirm the following to get correct heart rate and accurate analysis result.
    - The heart rate displayed on the screen is stable.
    - The electrode detachment or noise message does not appear.
    - The QRS sync mark displayed on the screen blinks in synchronization with the QRS sound included in the pen sound. To generate the pen sound, refer to “Machine settings” in Section 3.
    - Artifact is not included in the pen sound.

2. Wait at least 10 seconds for stable ECG waveforms. Immediately after electrodes are attached, the ECG waveforms may be unstable because of polarization voltage.

Detecting QRS Waves

The cardiograph detects QRS wave from leads II, V1 and V5. To assure QRS detection accuracy, take care to minimize superimposed artifact on these leads. Take care that QRS wave detection accuracy is reduced by artifact superimposed on these leads. Also when the amplitude of these QRS waves is too small (less than 0.5 mV), the cardiograph cannot detect the QRS wave.

NOTE

If low QRS wave can be seen on the screen and the QRS sync mark does not blink, the cardiograph does not analyze the ECG waveform and the “CANNOT ANALYSIS ECG” message is printed.

Counting the Heart Rate

The cardiograph counts the heart rate by averaging the latest five QRS waves and prints the heart rate together with the ECG waveforms.

Using the High-cut Filter

When using the 25 Hz EMG filter, the quality of ECG recording may be reduced. However, the high-cut filter does not affect the ECG analysis.

ECG Analysis

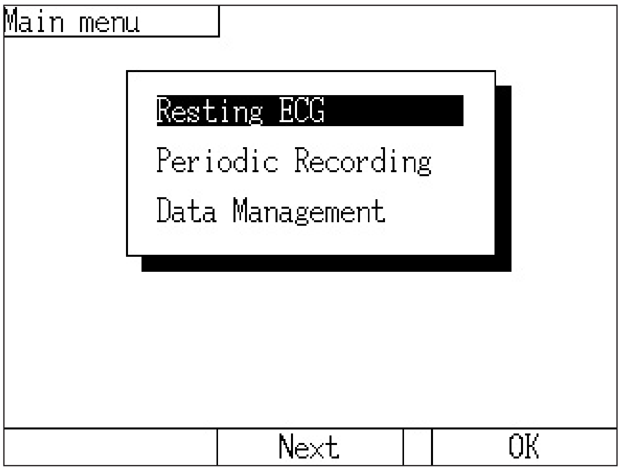
The cardiograph acquires 12 lead ECG waveforms simultaneously and analyzes 10 seconds of ECG waveforms. The selected leads and intervals of the waveforms are recorded on the paper. The ECG analysis result is incorrect if artifact is superimposed on the not-selected leads or interval. When an electrode detachment line or noise line is printed on the paper, artifact was superimposed on the ECG waveforms during acquisition. When any of these lines is printed, record the ECG waveforms again to assure accurate ECG analysis, verifying that all ECG leads are free from artifact.

The 12 lead ECG waveforms and ECG analysis result are recorded automatically.

Resting ECG recording screen

Calling up the Resting ECG Recording Screen.

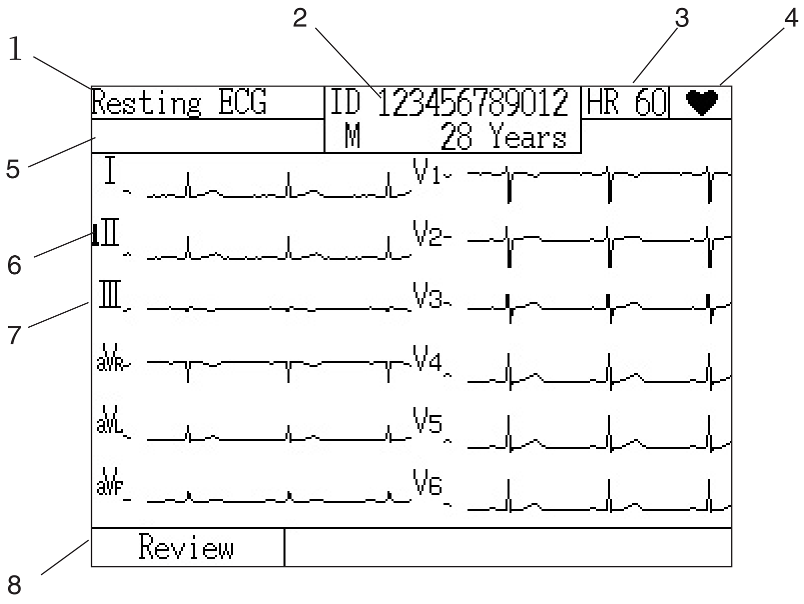
1. When the power is turned on, the Resting ECG screen appears. If another screen is displayed, press the MODE key to call up the Main Menu screen.



2. Select the “Resting ECG” with the F2 “NEXT” function key. “Resting ECG” is highlighted.

3. Press the F3 “OK” function key. The Resting ECG screen is displayed.

Explanation of the Resting ECG Screen



1. Selected mode in the Main Menu screen.

2. Patient information display area
   Patient ID number, age and sex are displayed. For the default settings, refer to Section 3 “Changing settings before measurement”.

3. Heart rate
   Updated every two seconds.

4. QRS sync mark
   Blinks in synchronization with the QRS wave.

5. Electrode status display area
   Displays the error message for electrode detachment.

6. CAL mark
   Indicates the sensitivity.

7. Waveform display area
   Each lead sync QRS: Beats for each 12 leads
   6 leads ×2: 2.8 seconds of each 12 lead ECG waveforms is displyed in 2 sequences of 6 channels.
   To select the waveform display format, refer to “Machine sttings” in Section 3.

8. Message and key function display area
   Displays the functions of the function keys F1 to F3 and screen message.

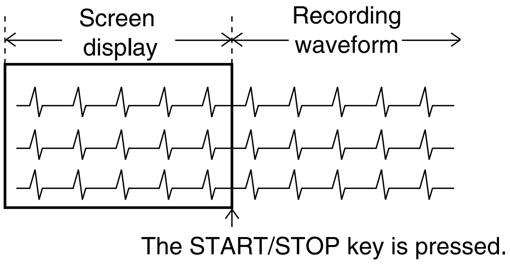
Automatic Recording

General

There are two automatic recording modes:

Real time recording

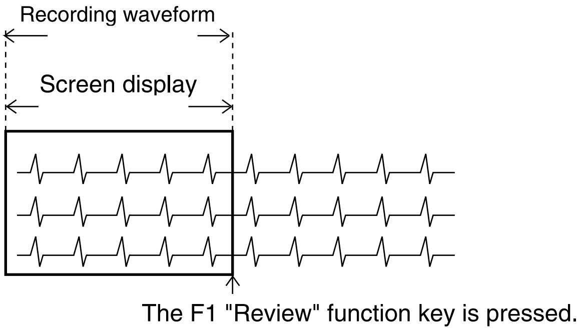
When you press the START/STOP key, the cardiograph starts recording real time ECG waveforms in the preset format. The ECG lead group is periodically switched according to the preset lead selection.



When "Auto start" is set to "On" and auto-start conditions are satisfied, real time recording automatically starts.

Review recording

When the Resting ECG mode is selected, the cardiograph checks for electrode detachment. When 2 seconds pass with no electrode detachment, the cardiograph starts acquiring and saving the ECG waveforms. So you can check the acquired ECG waveforms before recording starts. When the F1 "Review" function key is pressed, the cardiograph starts recording the saved waveforms from 10 seconds before the F1 "Review" function key is pressed.



Auto gain and auto position

During recording, if the total of all ECG waveforms exceeds the recording width, the sensitivity is automatically reduced to 1/2 (up to 1/8) and the waveforms are repositioned so that all waveform fit on the recording paper.

Preparation for Automatic Recording

Change the following settings, if necessary. Refer to “ Changing settings and printing” in Section 3. The factory default settings are underlined.
To print the current settings, refer to “Changing the settings before measurement” in Section 3.

Recording settings

- Grid recording (On, Off)

Prints a grid (vertical and horizontal lines as a scale) on plain paper.

- High speed recording (On (50 mm/s), Off (25 mm/s))

Paper speed for automatic recording and copy recording. When this item is set to “On”, recording time is shortened by half.

- Baseline drift suppression (Strong, Weak, Off)

Baseline drift suppression prevents the baseline from drifting by locking it into one position at the start of recording.

CAUTION

When baseline drift suppression is set to “Strong”, distortion may occur in the ST segment with a decrease of heart rate when heart rate is less than 50. For bradycardia, set this item to “Weak”.
The “Weak” setting has characteristics conforming to the AHA recommendations.

- High cut filter (75 Hz, 100 Hz, 150 Hz)

This is active only when the EMG filter is turned off.

- EMG suppression (25 Hz, 35 Hz)

EMG filter frequency

CAUTION

Take care when judging the ECG recording because the 25 Hz EMG filter may cause greater distortion of P-waves and QRS-waves depending on the waveform shape. The characteristics of the EMG filter are similar to those of a conventional analog filter.

- Lead mode selection (recording order)

Standard 12 leads: I, II, III, aVR, aVL, aVF, V1, V2, V3, V4, V5, V6
Cabrera leads: aVL, I, -aVR, II, aVF, III, V1, V2, V3, V4, V5, V6

Communication settings

- After receiving (Save, Print, Save and Print)

Operation of the connected cardiograph or personal computer after it receives the ECG data file.

NOTE

When transferring the ECG data file after recording, select the operation of the connected cardiograph or PC before starting recording. If the connected cardiograph or PC cannot save the received ECG data, you must select “Print”.

Auto recording settings

- Waveform recording format

3 ch (12 lead):	The 12 leads are recorded in 4 sequences of 3 channels each. Each sequence takes 2.5 seconds.
6 ch (12 lead):	The 12 leads are recorded in 2 sequences of 6 channels each. Each sequence takes 5 seconds
3 ch (12 lead) + rhythm:	The 12 leads are recorded in 4 sequences of 3 channels each. Each sequence takes 2.5 seconds. 1 channel rhythm lead is also recorded.
3 ch rhythm average:	One channel of 12 averaged waveforms for each of 12 leads and 3 channels of rhythm leads (lead II, V1 and V5) are recorded.
6 ch (12 lead) 50 mm/s:	The 12 leads are recorded in 2 sequences of 6 channels each at the speed of 50 mm/s. Each sequence takes 5 seconds when using the recording paper with paper marks every 140 mm.
6 ch (12 lead) 50 mm/s F:	The 12 leads are recorded in 2 sequences of 6 channels each at the speed of 50 mm/s. Each sequence takes 5 seconds when using the recording paper with paper marks every 295 mm.

- Auto start (On, Off)

When “Auto start” is set to “On”, the real time recording is automatically started according to the preset recording format and lead selection when all of the following conditions are satisfied:

- ♦ In automatic recording mode, the recording is not started.
- ♦ No electrode detachment is detected for two seconds or more.
- ♦ Five or more QRS waves are detected.
- ♦ No artifact, high frequency noise or baseline drift are detected

NOTE

This function is only available following attachment of the electrodes.

- Extended recording (On, Off)

Records the rhythm lead (lead II) when an arrhythmia is detected. 60 seconds of the rhythm lead is recorded in 6 traces on one or more pages. The number of pages depends on the page length of the recording paper.

- Auto feed after recording (On, Off)

Automatically feeds the paper to the paper mark after recording.

- Auto file save (On, Off)

The ECG waveform can be saved after recording when this item is set to “On”.

- Include reason (On, Off)

Records the reason for the findings when this item is set to “On”.

Automatic Recording Procedure

CAUTION

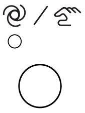
- **When "Auto start" is set to "On", enter the patient age and sex before attaching the electrodes to the patient. After the electrodes are attached and the ECG waveform is stable, the recording automatically starts and the default settings of the patient age and sex are used for ECG analysis. For ECG analysis details, refer to the User's Guide "ECAPS 12C ECG Interpretation Program".**
- **Enter the patient age and sex before recording. If not, the ECG analysis is performed with the patient as male and 35 years old.**
- **When the "Do not turn the power off" message appears during saving or transferring the ECG data file, do not turn the power off. Otherwise, the data will be lost.**

NOTE

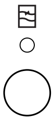
In automatic recording mode, the sensitivity is fixed at 10 mm/mV and the paper speed is fixed at 25 mm/s.

1. Check the following before starting recording.
    - The electrodes (especially chest electrodes) are not in electrical contact with each other and they are property attached and there is no artifact. When the electrode attachment is correct and there is no artifact, no electrode detachment or no error message appears and the QRS sync lamp blinks in synchronization with the QRS sound in the pen sound.
    - The patient is relaxed.

2. Enter the patient information. Refer to "Entering the patient information" in Section 4.



3. Check that the AUTO/MANUAL lamp is lit. If it is not lit, press the AUTO/ MANUAL key.



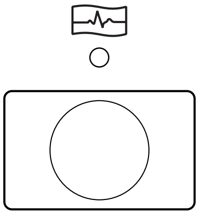
4. If necessary, press the FILTER key to turn the EMG filter on with the FILTER key.

5. Select the real time or review recording mode by pressing the START/STOP key (real time recording) or F1 "Review" function key (review recording). The cardiograph automatically records the ECG waveforms and changes the lead groups.

Auto start

When "Auto start" is set to "On" and all of the following conditions are satisfied, real time recording automatically starts.

- No electrode detachment is detected for two seconds or more.
- Five or more QRS waves are detected.
- No artifact, high frequency noise or baseline drift is detected.



To manually stop recording, press the START/STOP key.

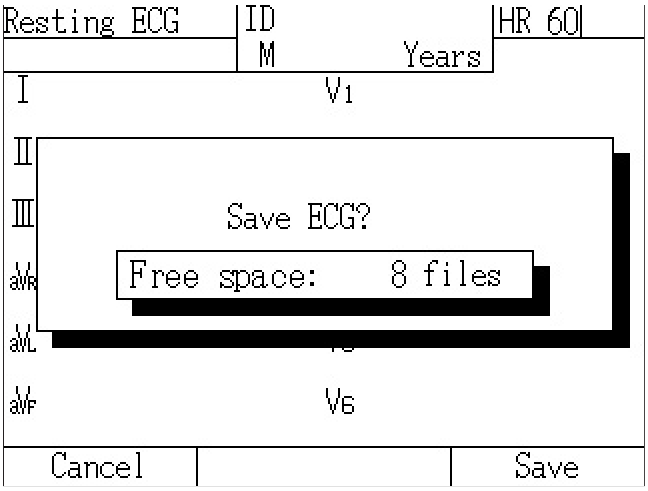
Extended arrhythmia rhythm recording

During recording, when an arrhythmia is detected, 60 seconds of the rhythm lead is recorded in 6 traces on one or more pages. The number of pages depends on the page length of the recording paper. While acquiring the rhythm lead, the START/STOP lamp is lit.

To stop recording, press the START/STOP key. This recording does not stop until the acquired waveforms are recorded.

Saving the ECG Data File

When “Auto file save” is set to “On”, the “Save ECG?” message appears.



Save ECG?

Free space: 8 files

10 seconds of 12 lead ECG waveforms, analysis result and patient information can be saved in a memory card as an ECG data file. The number of available ECG data files to be saved in the memory card is displayed in “Free space:”. This number varies depending on the waveform quality.

NOTE

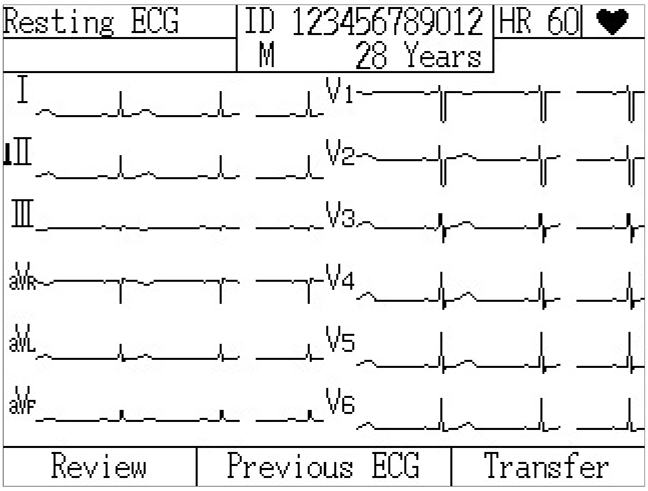
A memory card formatted on an ECG-9130K cardiograph can save up to three ECG data files which have the same ID number or no ID number. If a 4th ECG data file which has the same ID number or no ID number is saved in the memory card, the oldest file which has the same ID number or no ID number is automatically deleted.
A memory card formatted by the ECG-9320A/K cardiograph can save any number of files which have the same ID number or no ID number.

To save the ECG waveforms, press the F3 “Save” function key.

To cancel saving, press the F1 “Cancel” function key.

Transferring the ECG Data File

After the ECG data file is saved, the cardiograph can transfer the saved file and the “Transfer” key function appears on the F3 function key display area.



Resting ECG
ID 123456789012
HR 60
M 28 Years

To transfer the ECG data file, press the F3 “Transfer” function key.

Copy Recording

⇨/▼
○
◯

After automatic recording ends, the COPY/CAL lamp is lit. You can make one or more copies of the recording results by pressing the COPY/CAL key. The automatic recording result and extended arrhythmia rhythm recording result can be recorded. The word “COPY” is also printed at the top of the recording paper to distinguish it from automatic recording results. If the FILTER key setting is changed, the changed setting applies to the copy recording.

Recording the Previous ECG Data in Memory Card.

If the memory card has a previously saved ECG data file which has the same ID number, you can record the previously saved ECG data by pressing the F2 “Previous ECG” function key.

Manual Recording

General

You can manually record the ECG waveform. During recording you can annotate the ECG waveforms when there is a change in patient condition such as chest pain or artifact. In manual recording mode, the baseline is automatically adjusted every time recording is started and the lead group or sensitivity is changed. The ECG analysis is not available in the manual recording mode.

Preparation for Manual Recording

Change the following settings, if necessary. Refer to Section 3 "Changing settings before measurement". The factory default settings are underlined.

To print out the current settings, refer to "Changing settings and printing" in Section 3.

Recording settings

- Grid recording (On, Off)

Prints a grid (vertical and horizontal lines as a scale) on plain paper.

- Slow paper speed (12.5 mm/s, 10 mm/s, 5 mm/s)

Additional paper speed for manual recording and external recording

- Baseline drift suppression (Strong, Weak, Off)

Baseline drift suppression prevents the baseline from drifting by locking it into one position at the start of recording.

CAUTION

When baseline drift suppression is set to "Strong", distortion may occur in the ST segment with a decrease of heart rate when heart rate is less than 50. For bradycardia, set this item to "Weak".
The "Weak" setting has characteristics conforming to the AHA recommendations.

- High cut filter (75 Hz, 100 Hz, 150 Hz)

This is active only when the EMG filter is turned off.

- EMG suppression (25 Hz, 35 Hz)

EMG filter frequency

CAUTION

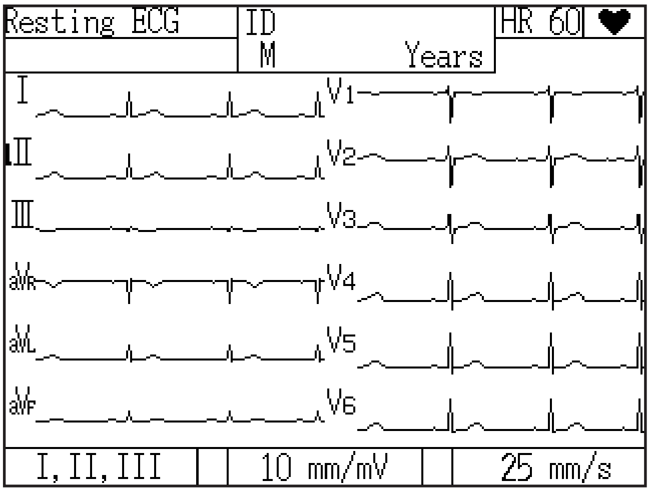
Take care when judging the ECG recording because the 25 Hz EMG filter may cause greater distortion of P-waves and QRS-waves depending on the waveform shape. The characteristics of the EMG filter are similar to those of a conventional analog filter.

Manual recording settings

- Recording channels (3 ch, 3 ch + rhythm, 6 ch, 12 ch)

Manual Recording Procedure

1. Check the following before starting recording
   - The patient is relaxed.
   - The electrodes (especially chest electrodes) are not in electrical contact with each other and they are properly attached and there is no artifact. When the electrode attachment is correct and there is no artifact, no electrode detachment and noise message is displayed and the QRS sync mark blinks in synchronization with the QRS sound included in the pen sound.
2. Press the AUTO/MANUAL key to select the manual recording mode.



Resting ECG | ID M Years | HR 60 ♥

I,II,III | 10 mm/mV | 25 mm/s

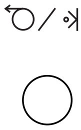
3. Press the F1 function key to select the first lead group.

3 ch, 3 ch + rhythm: I, II, III → aVR, aVL, aVF → V1, V2, V3 → V4, V5, V6 → EXT-IN
6 ch: I, II, III, aVR, aVL, aVF → V1, V2, V3, V4, V5, V6, → EXT-IN
12 ch: I, II, III, aVR, aVL, aVF, V1, V2, V3, V4, V5, V6, → EXT-IN

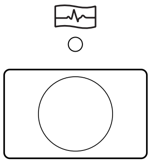
To change the paper speed, press the F3 function key.
Paper speed: 5, 10, 12.5, 25 or 50 mm/s.
5, 10 or 12 .5 mm/s is available with the “Slow paper speed” setting of the System setup.

To change the sensitivity, press the F2 function key.
Sensitivity: ×1/2 (5mm/mV), ×1 (10mm/mV), ×2 (20 mm/mV)

To turn on the EMG filter press the FILTER key.



To annotate the ECG waveform, press the FEED/MARK key. While this key is pressed the dotted line is printed.



4. Press the START/STOP key to start recording.

5. Select the next lead group with the F1 function key. When the lead group is changed, the calibration waveform is automatically recorded.

6 Repeat step 5 to record all lead groups.

7 When all lead groups are recorded, press the START/STOP key.

Rhythm Recording

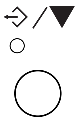
General

Before or after automatic or manual ECG recording, you can record 60 seconds of the rhythm lead (lead II) in 3 traces for 2 pages

Recording procedure

Press the RHYTHM key. The cardiograph starts to acquire the ECG waveforms and the elapsed time from start of the ECG waveform acquisition is displayed at the right bottom of the screen. When 60 seconds of ECG waveforms are acquired, the recording is started.

To stop ECG waveform acquisition, press the RHYTHM key again.



After recording, you can make one or more copies of recording results by pressing the COPY/CAL key.

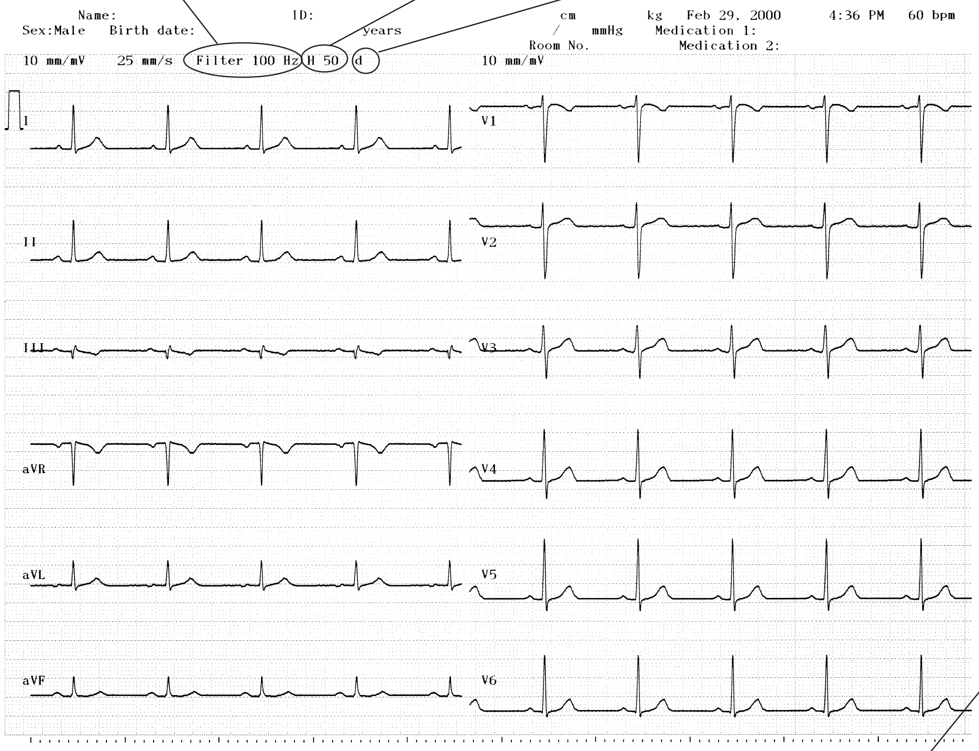
Recording Example

Auto Recording Example

High cut filter and EMG filter indications
Filter 150 Hz – 150 Hz High cut filter
Filter 100 Hz – 100 Hz High cut filter
Filter 75 Hz – 75 Hz High cut filter
Filter 35 Hz – 35 Hz EMG filter
Filter 25 Hz – 25 Hz EMG filter

AC filter indications
H 50 – 50 Hz AC filter
H 60 – 60 Hz AC filter
None – Off

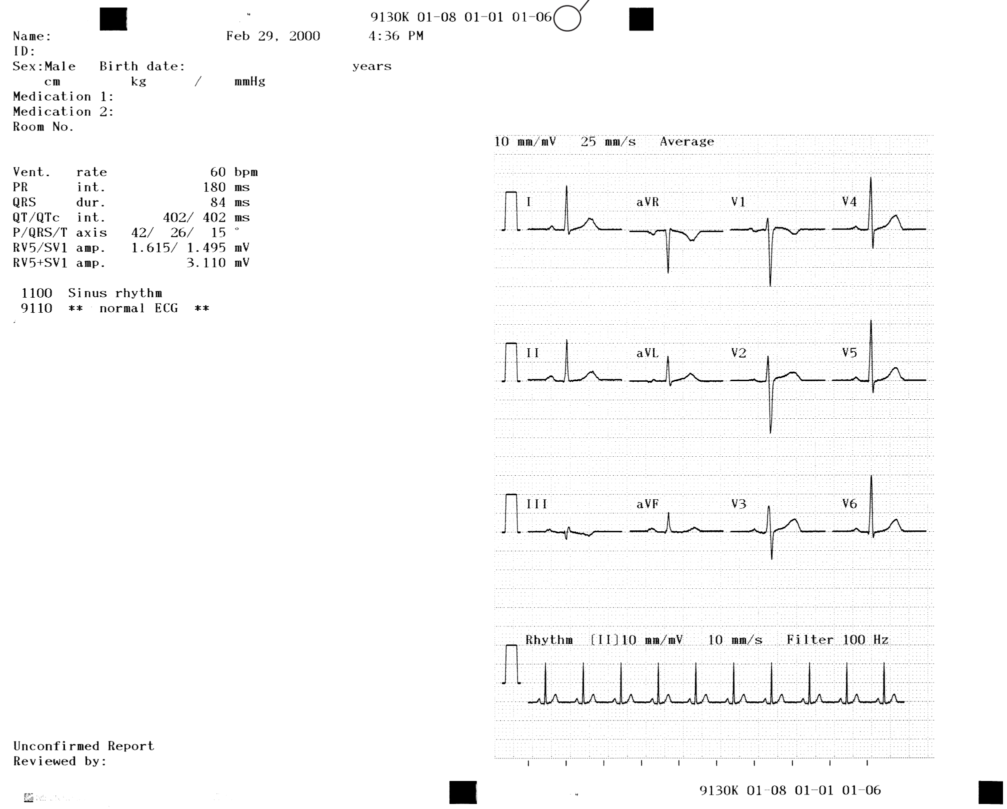
Baseline drift suppression indications
D – Strong
d – Weak
None – Off



```
       Name:                    ID:                           cm          kg   Feb 29, 2000      4:36 PM   60 bpm
Sex:Male   Birth date:                         years            /     mmHg    Medication 1:
                                                          Room No.           Medication 2:
10 mm/mV    25 mm/s  Filter 100 Hz H 50  d                10 mm/mV
```

Pacing detection sense indications
P – Low
None – High

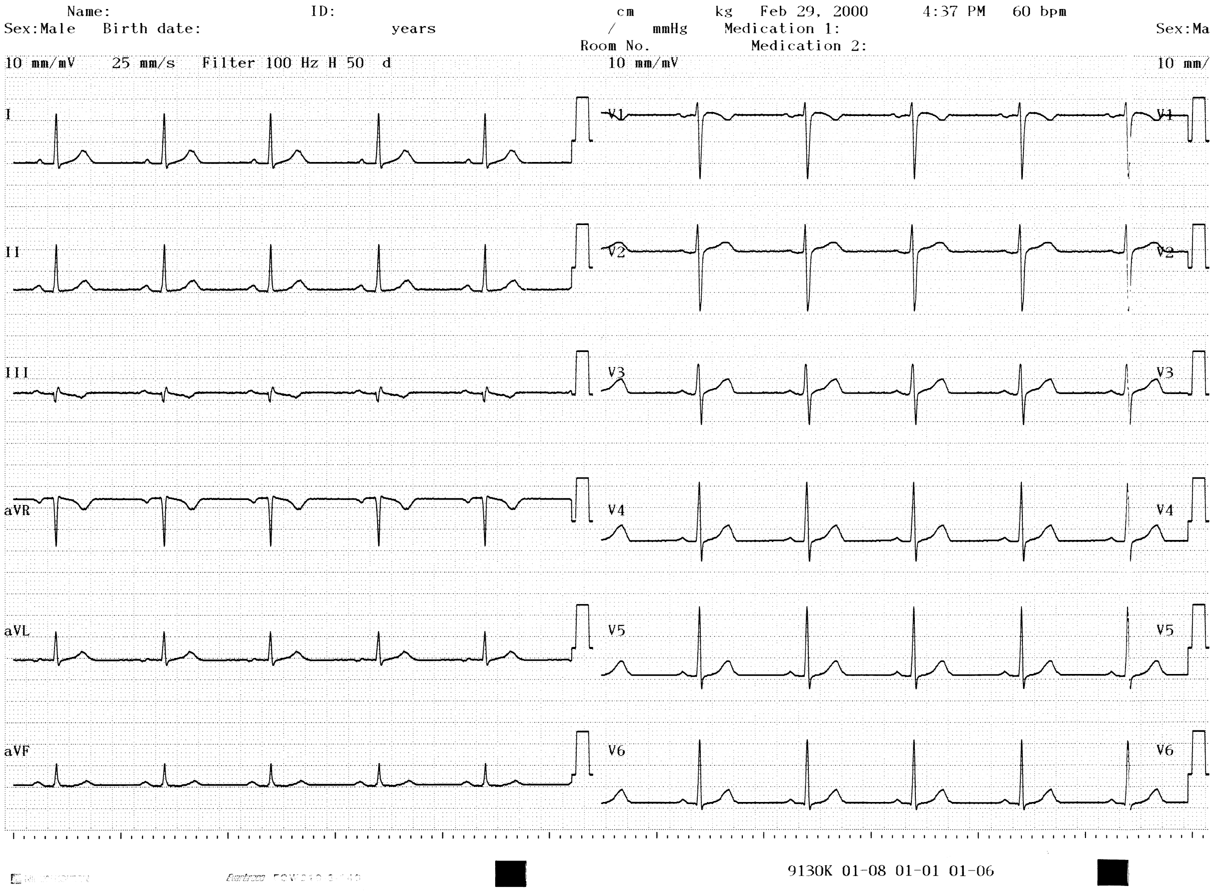
→



```
9130K 01-08 01-01 01-06
Name:                      Feb 29, 2000      4:36 PM
ID:
Sex:Male   Birth date:                         years
    cm          kg      /     mmHg
Medication 1:
Medication 2:
Room No.

Vent.   rate             60 bpm
PR      int.            180 ms
QRS     dur.             84 ms
QT/QTc  int.        402/ 402 ms
P/QRS/T axis   42/  26/  15 °
RV5/SV1 amp.   1.615/ 1.495 mV
RV5+SV1 amp.          3.110 mV

 1100  Sinus rhythm
 9110  **  normal ECG  **

Unconfirmed Report
Reviewed by:
```

```
10 mm/mV   25 mm/s   Average

Rhythm  [II]10 mm/mV   10 mm/s   Filter 100 Hz

9130K 01-08 01-01 01-06
```

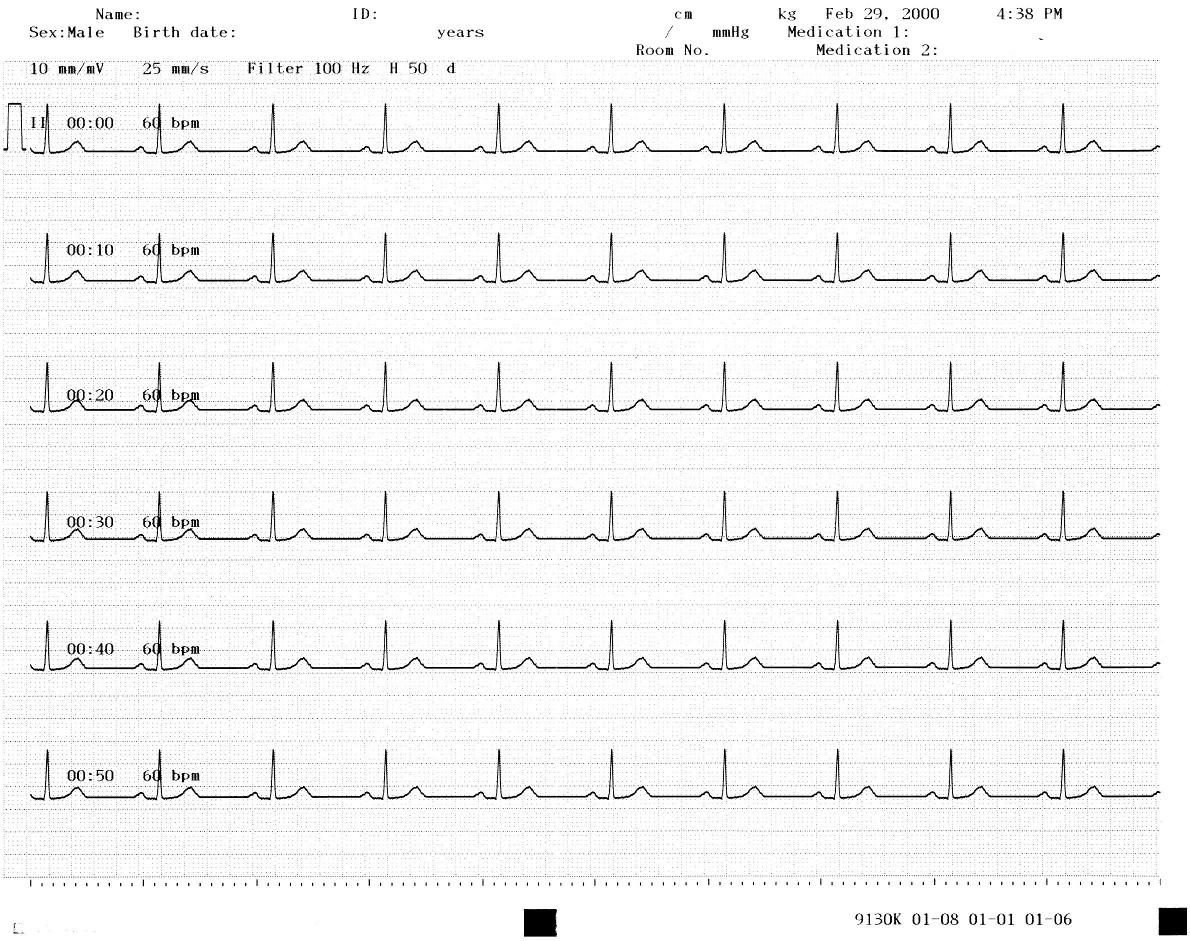
Manual Recording Example



Name: ID: cm kg Feb 29, 2000 4:37 PM 60 bpm
Sex:Male Birth date: years / mmHg Medication 1: Sex:Ma
Room No. Medication 2:
10 mm/mV 25 mm/s Filter 100 Hz H 50 d 10 mm/mV 10 mm/

9130K 01-08 01-01 01-06

Rhythm Recording



Name: ID: cm kg Feb 29, 2000 4:38 PM
Sex:Male Birth date: years / mmHg Medication 1:
Room No. Medication 2:
10 mm/mV 25 mm/s Filter 100 Hz H 50 d

9130K 01-08 01-01 01-06

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Section 6 Periodic ECG Recording

General 6.1
Preparation for Periodic ECG Recording 6.2
Recording Procedure 6.3
Recording Example 6.5

General

The cardiograph can automatically perform automatic recording at periodic intervals, and the selected leads can be recorded at 10 mm/s (additional slow speed recording). For automatic recording, refer to Section 5 “Recording Resting ECG Waveforms”. You can also perform automatic and manual recording during periodic ECG recording.

Preparation for Periodic ECG Recording

Change the following settings, if necessary. Refer to Section 3 “Changing settings before measurement”. The factory default settings are underlined.

To print out the current settings, refer to “Changing settings and printings” in Section 3.

Periodic recording settings

- Starting leads (Limb, Chest)

Starting lead groups

- Time settings: Interval (1-60 min (1 min))

Interval between periodic ECG recording.

- Additional slow speed recording (On, Off)

Select “On” to record the leads set in “Recording channels” of the Resting ECG settings. The recording speed is 10 mm/s.

- Auto gain (On, Off)

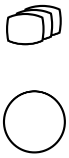
Select “On” to use the auto gain and auto position function.
Auto gain and auto position:
If the ECG waveform exceeds the maximum recording width, the waveform amplitude is automatically reduced to 1/2 (up to 1/8) and repositioned so that the entire waveform can be recorded on the recording paper (auto gain). Auto gain is based on the sensitivity setting before recording.

Resting ECG settings

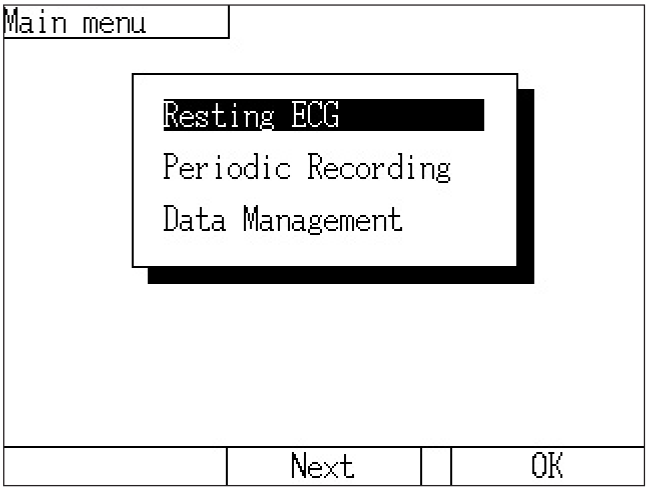
- Recording channels (3 ch, 3ch + rhythm, 6 ch)

The number of recording channels and leads for the additional slow speed recording:
3 ch: II, aVF, V5
3ch + rhythm: Same as 3 ch
6 ch: I, II, aVF, V1, V5, V6
12 ch: Lead I to V6

Recording Procedure

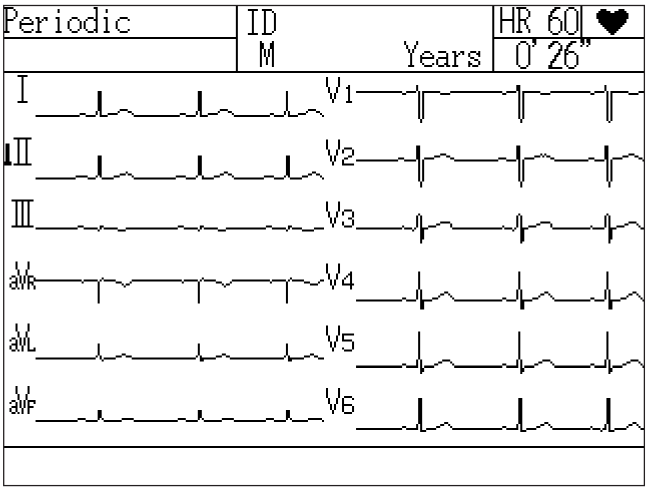


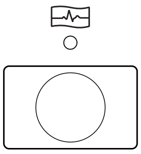
1. Press the Mode key to call up the Main Menu screen.



2 Select “Periodic Recording” with the F2 “NEXT” function key. “Periodic Recording” is highlighted.

3. Press the F3 “OK” function key. The Periodic Recording screen is displayed.





4. Press the START/STOP key. All operations (automatic recording and additional slow speed recording) are automatically performed in the preset settings.
   To temporarily stop the recording, press the START/STOP key. If this key is pressed during additional slow speed recording, this recording is stopped. When the next periodic ECG recording is performed, the additional slow speed recording is started again.

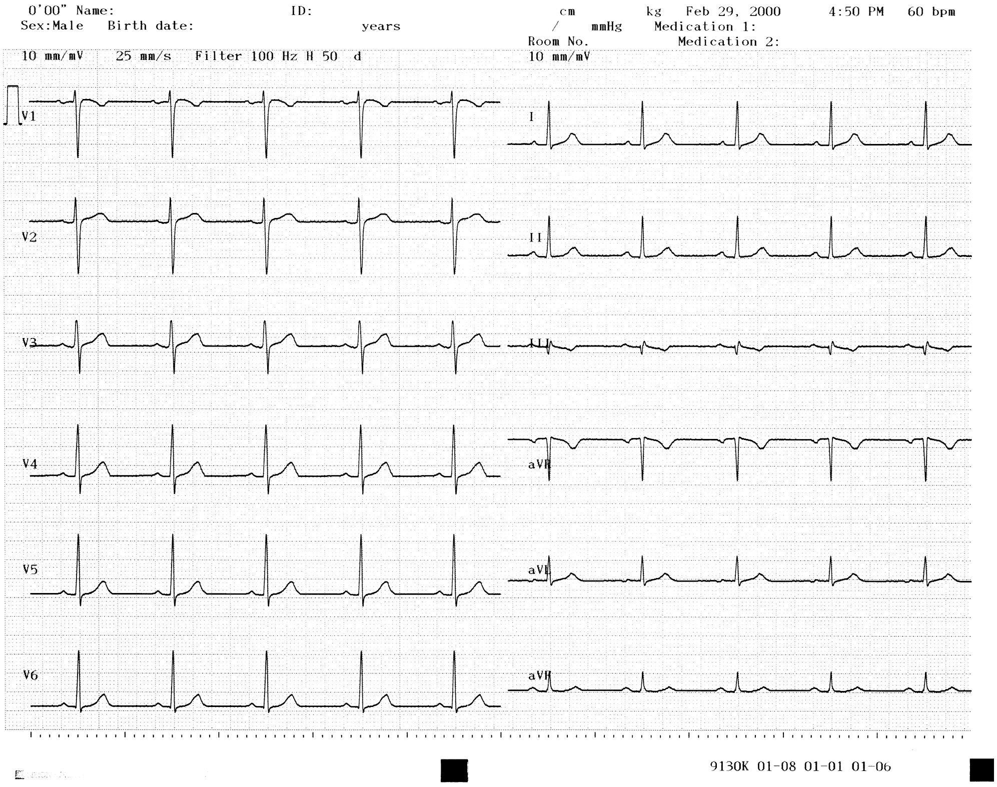
To perform the normal automatic or manual recording:

1) Press the START/STOP key.
2) Select automatic or manual recording with the AUTO/MANUAL key.
3) Press the START/STOP key again to start automatic or manual recording. After automatic or manual recording, the periodic recording automatically resumes.

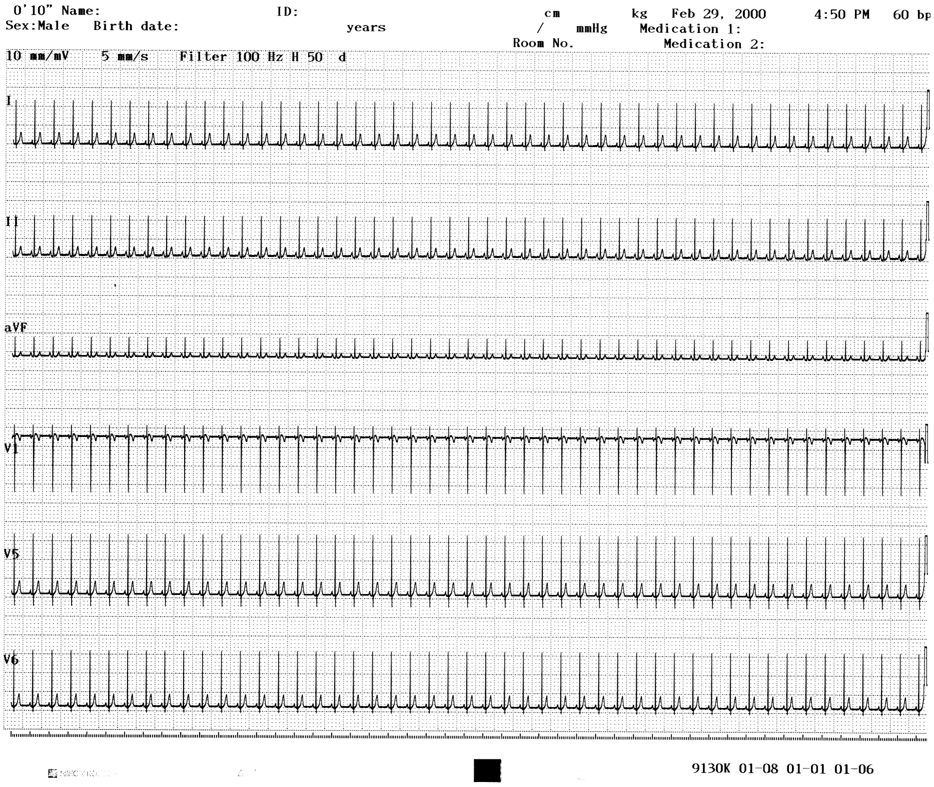
5. Press the START/STOP key to stop periodic recording.

   To switch to antoher screen, call up the Main menu screen by pressing the MODE key.

Recording Example


0'00" Name: ID: cm kg Feb 29, 2000 4:50 PM 60 bpm
Sex:Male Birth date: years / mmHg Medication 1:
Room No. Medication 2:
10 mm/mV 25 mm/s Filter 100 Hz H 50 d 10 mm/mV

9130K 01-08 01-01 01-06


0'10" Name: ID: cm kg Feb 29, 2000 4:50 PM 60 bp
Sex:Male Birth date: years / mmHg Medication 1:
Room No. Medication 2:
10 mm/mV 5 mm/s Filter 100 Hz H 50 d

9130K 01-08 01-01 01-06

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Section 7 External Signal Recording

General 7.1
Connecting an External Instrument 7.2
Recording Procedure 7.3
Recording Example 7.4

General

You can record an analog signal from external instruments such as an AK-101E Mechanocardiograph, on channel 1 and channel 2together with the lead II ECG waveform on channel 2.

NOTE

- **An analog signal is input synchronized with the ECG waveforms. When “Baseline drift suppression” of “Recording settings” in the System setup is set to “strong” or “weak”, recorded signals are delayed about 1.4 seconds for the “strong” setting and about 1.6 seconds for the “weak” setting compared with the input signals.**
- **External signal recording is only available when manual recording mode is selected.**

To perform recording without this delay, set the “Baseline drift suppression” to “Off.”

Connecting an External Instrument

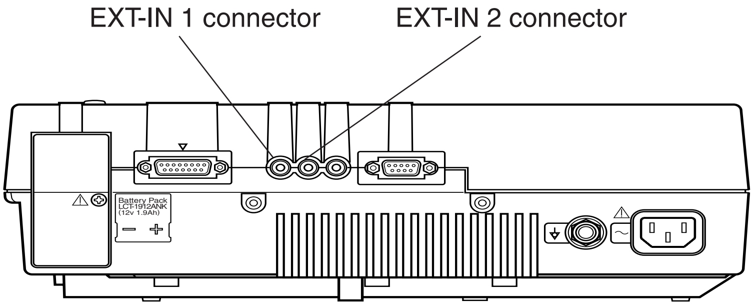
CAUTION

- **When connecting an external instrument to the EXT-IN connector, ensure that the external instrument complies with the IEC 601-1 safety standard for medical equipment or CISPR 11 Section Edition 1990-09, Group 1 and Class B standard. When the external instrument does not comply with either of these standards, use a locally available medical use isolation transformer unit between the external instrument and the AC outlet.**
- **When the cardiograph operates on battery power and large leakage current is input from the connected external instrument, ground the cardiograph or use an isolation transformer for the external instrument. Failure to follow this caution may cause electrical shock to the patient and operator.**

NOTE

When connecting an external instrument to the EXT-IN 1 or 2 connecter, an unwanted radio frequency signal is from this connection. To reduce this unwanted radiofrequency signal, attach an optional ferrite core to the cable of the external instrument. Refer to “Attaching the ferrite core” in Section 10 “Reference”.

Connect an external instrument to the EXT-IN connector on the right side panel of the cardiograph. For the connector pin assignment, refer to “Connector Pin Assignment” in Section 11



Using connector: SG-8036 (Code No.: 273446)
Mating connector: AP-313 3.5mm φ miniature plug (Code No.: 5440283)

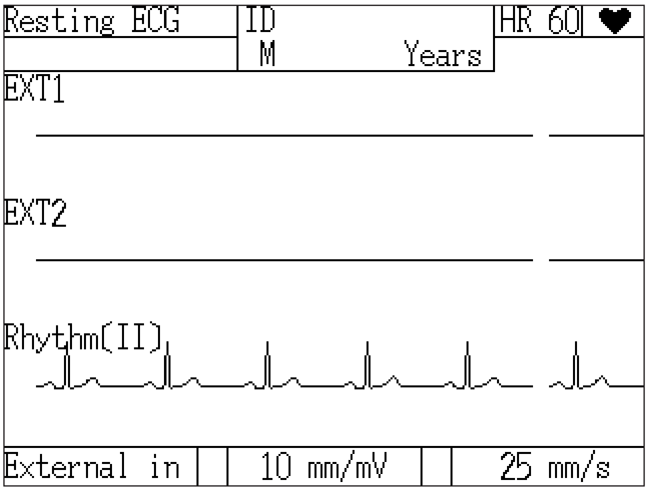
Pin No.	**Signal**
1	EXT-IN 1 or 2
2	GND

Input sensitivity: 10 mm/0.5 V, input impedance 100 kΩ or more

Recording Procedure

1. Check that the AUTO/MANUAL lamp is not lit. If it is lit, press the AUTO/MANUAL key.

2. From the Restimg ECG screen, select the “ External in” with the F1 function key.



Resting ECG | ID | HR 60 ♥
M Years
EXT1
EXT2
Rhythm(II)
External in | 10 mm/mV | 25 mm/s

To change the paper speed, press the F3 function key.
Paper speed: 5, 10, 12.5, 25 or 50 mm/s.
5, 10 or 12.5 mm/s is available with the “Slow paper speed” setting of the System setup.

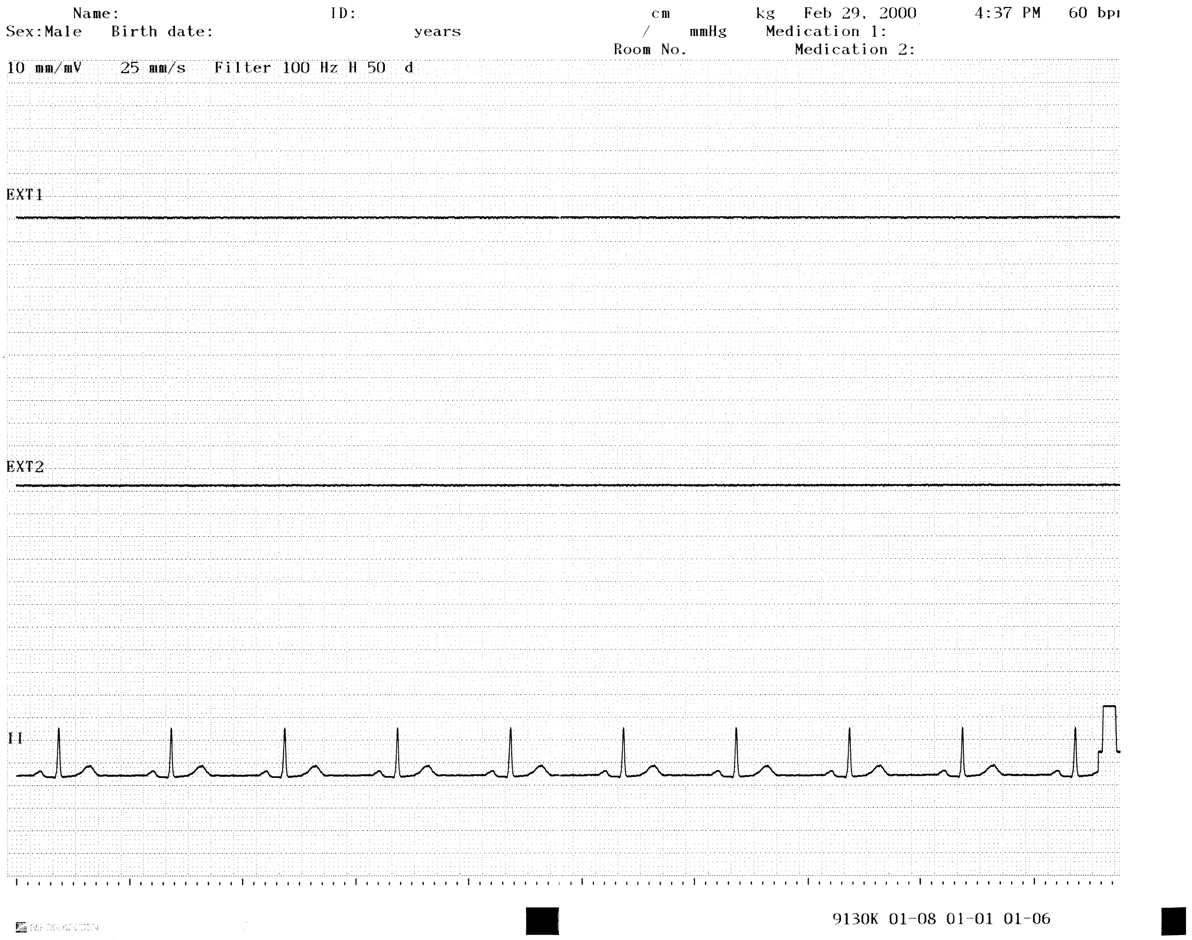
To change the sensitivity, press the F2 function key.
Sensitivity for lead II: ×1/2 (5mm/mV), ×1 (10mm/mV), ×2 (20 mm/mV)
The sensitivity of the external input signal is fixed to 0.5 V/10 mm.

To turn on the EMG filter press the FILTER key.

To annotate the ECG waveform, press the FEED/MARK key. While this key is pressed, the dotted line is printed.

3. Press the START/STOP key to start recording. To stop recording, press the START/STOP key again.

Recording Example



Name: ID: cm kg Feb 29, 2000 4:37 PM 60 bp
Sex:Male Birth date: years / mmHg Medication 1:
Room No. Medication 2:
10 mm/mV 25 mm/s Filter 100 Hz H 50 d

9130K 01-08 01-01 01-06

Section 8 Data Management

General 8.1
Calling up the Data Management Screen 8.2
Transferring ECG Data Files 8.3
    General 8.3
    Selecting the Operation of the Connected Cardiograph or Personal Computer 8.3
    Calling up the Transfer Screen 8.4
    Transferring All ECG Data Files 8.4
    Transferring One ECG Data File 8.6
Recording the ECG Data in a Memory Card 8.9
Changing the ID Number of an ECG Data File in a Memory Card 8.12
Receiving an ECG Data File 8.14
Deleting ECG Data Files 8.16
Formatting the Memory Card 8.19
Recording the File List in a Memory Card 8.21

General

In the automatic recording mode, 10 seconds of ECG waveforms, analysis result and patient information can be saved as an ECG data file in a memory card. Up to 3,200 files can be saved in a memory card.

In the Data Management screen, you can do any of the following operations.

- Transfer one or all ECG data files from a memory card to another cardiograph or personal computer.
- Record the ECG data file in a memory card.
- Change the patient ID number of an ECG data file in a memory card.
- Receive and record an ECG data file from another cardiograph or personal computer.
- Delete ECG data files in a memory card.
- Format a memory card.
- Record the file list in a memory card

The cardiograph can connect to another Nihon Kohden cardiograph* with a serial cable or modem for transferring and receiving an ECG data file.

* ECG-9020K, ECG-9320A/K cardiograph

CAUTION

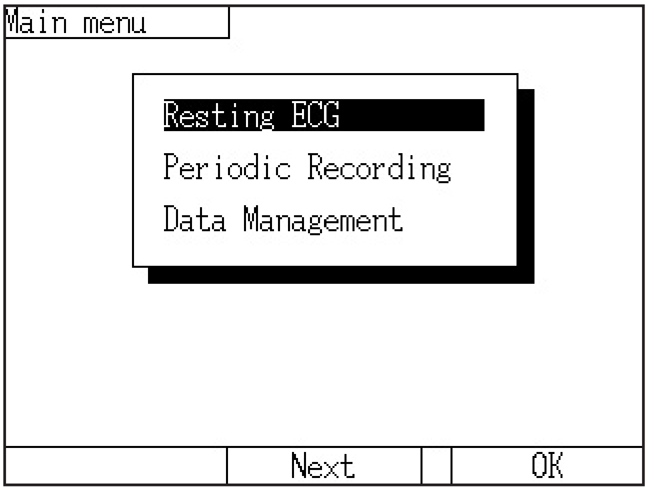
- **Use only the QM-040V memory card.**
- **Format the memory card before the first use.**
- **Format the memory card only in an ECG-9130K or ECG-9320A/K cardiograph. Memory cards formatted in other ECG models cannot be used in this cardiograph.**
- **Do not press the memory card eject button or turn the power off while data is being written to or read from the card. Otherwise, the memory or saved data may be damaged.**
- When the “Do not turn the power off” message appears during operation, do not turn the power off. Otherwise, the memory card may be damaged and data will be lost.

NOTE

The cardiograph can only manage ECG-9000 Series Type 2 ECG data files.

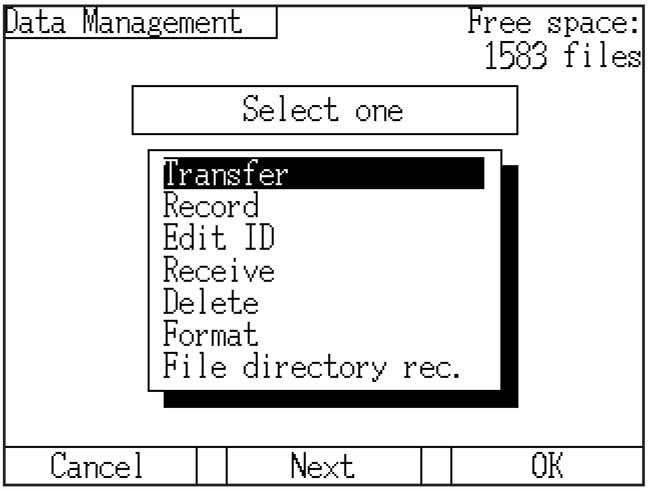
Calling up the Data Management Screen

1. Press the MODE key to call up the Main menu screen.



2. Select “Data Management” with the F2 “NEXT” function key. “Data Management” is highlighted.

3. Press the F3 “OK” function key. The Data Management screen is displayed and the number of available ECG data files which can be saved in the memory card is displayed at the right upper corner of screen.



To select the desired function, use the F2 “NEXT” function key, then press the F3 “OK” key.

To close the Data Management screen, press the F1 “Cancel” function key. The Main Menu is displayed.

Transferring ECG Data Files

General

You can transfer one or all ECG data files from the memory card to another cardiograph or personal computer. After transferring, the transferred ECG data files are automatically deleted from the memory card.

Selecting the Operation of the Connected Cardiograph or Personal Computer

1. Call up the System Setup screen. Refer to “Changing setting and printing” in Section 3

2. Enter “412 (Save)”, “413 (Print)” or “414 (Save and Print)” with the keyboard.

“After receiving” or “Transfer option” (Communication settings)

Save: The connected cardiograph or PC automatically saves the received ECG data file in the internal memory or memory card.

Print: The connected cardiograph or PC automatically prints the received ECG data but does not save it.

Save and Print: The connected cardiograph or PC automatically saves the received ECG data file in the internal memory or memory card and prints the ECG data.

NOTE

- **If the connected cardiograph or PC cannot save the transferred ECG data, you must select “Print”.**
- **When “Print” is selected, the selected ECG data file is not deleted after transferring.**

3. Press the START/STOP key to save the changed setting.

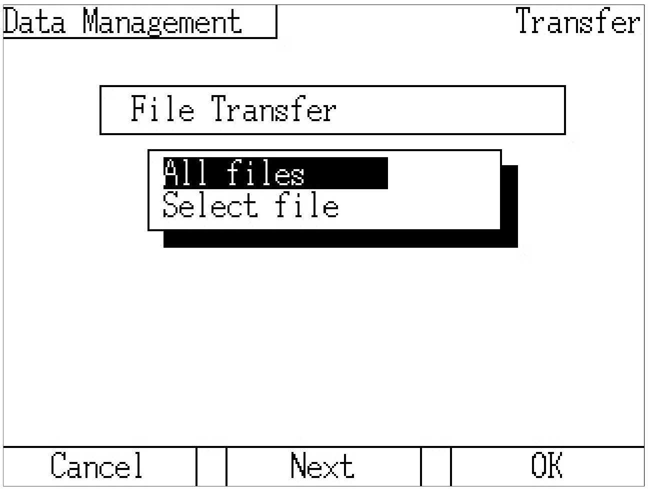
4. Press the Power key to restart the cardiograph with the new setting.

Calling up the Transfer Screen

1. Call up the Data Management screen. Refer to the “Calling up the Data Management screen.”

2. Select “Transfer” with the F2 “NEXT” function key. “Transfer” is highlighted.

3. Press the F3 “OK” function key. The Data Management - Transfer screen is displayed.


Data Management
Transfer
File Transfer
All files
Select file

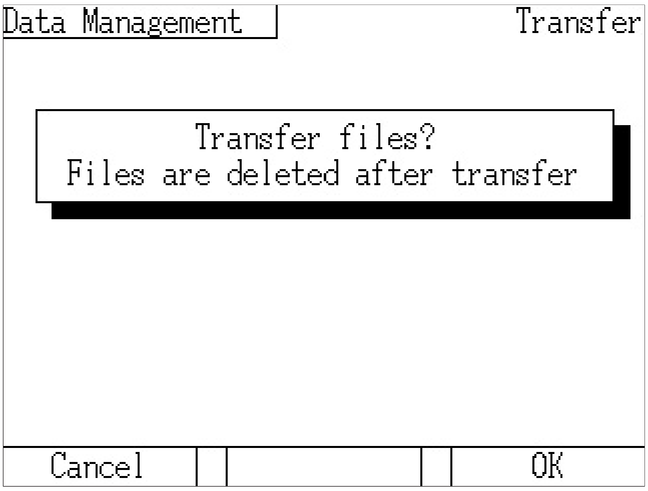
To return to the Data Management screen, press the F1 “Cancel” function key

Transferring All ECG Data Files

All ECG data files can be transferred from the memory card to another cardiograph or personal computer.

1. From the Transfer screen, select “All files” with the F2 “ Next” function key. “All files” is highlighted.

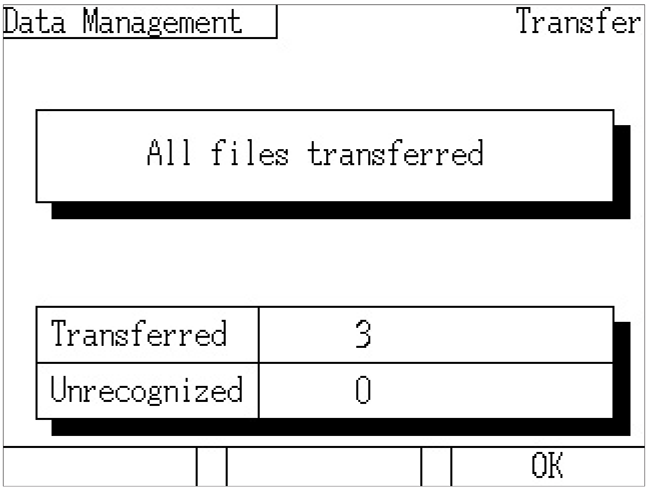
2. Press the F3 “OK” function key. All ECG data files in the memory card are transferred to another cardiograph or personal computer.


Data Management
Transfer
Transfer files?
Files are deleted after transfer

To cancel transferring, press the F1 “Cancel” function key. The Data management screen is displayed.

To cancel transferring while transferring the ECG data files, press the F3 “Cancel” function key. After the current ECG data file is transferred, the transfer operation is canceled and the “Abort” message appears. Press the F3 “OK” function key. The Data management screen is displayed.

3. When all files are transferred, the “All files transferred” message appears. Press the F3 “OK” function key. The Data Management screen is displayed.



Data Management

Transfer

All files transferred

Transferred	3
Unrecognized	0

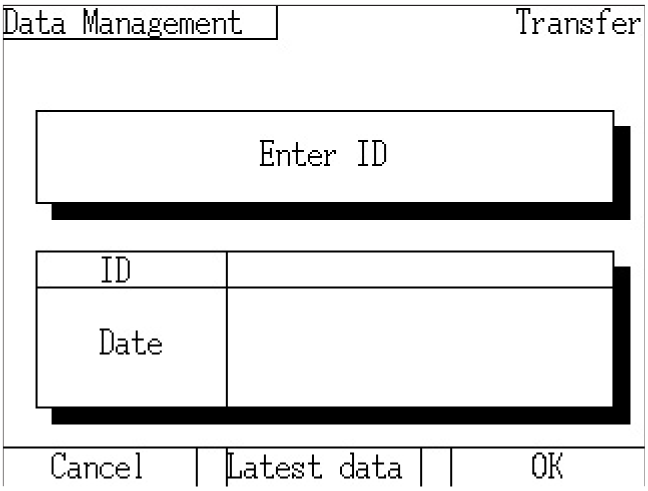
Unrecognized: Number of files which the cardiograph cannot manage.

Transferring One ECG Data File

You can select one ECG data file in the memory card by entering the ID number. The selected file is transferred to another cardiograph or personal computer.

1. From the Transfer screen, select “Select file” with the F2 “Next” function key. “Select file” is highlighted.

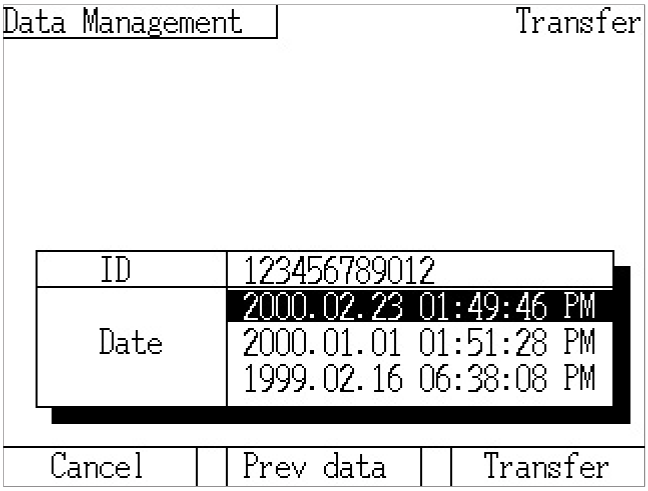
2. Press the F3 “OK” function key. The Data Management - Transfer - Enter ID screen is displayed.



To return to the Data Management screen, press the F1 “Cancel” function key.

3. Do one of the following.
   To select the ECG data file by the ID number:
   1) Use the keyboard on the operation panel to enter the ID number of the ECG data file.

   2) Press the F3 “OK” function key. The ID number and examination date of the selected ECG data file are displayed.



ID	123456789012
Date	2000.02.23 01:49:46 PM 2000.01.01 01:51:28 PM 1999.02.16 06:38:08 PM

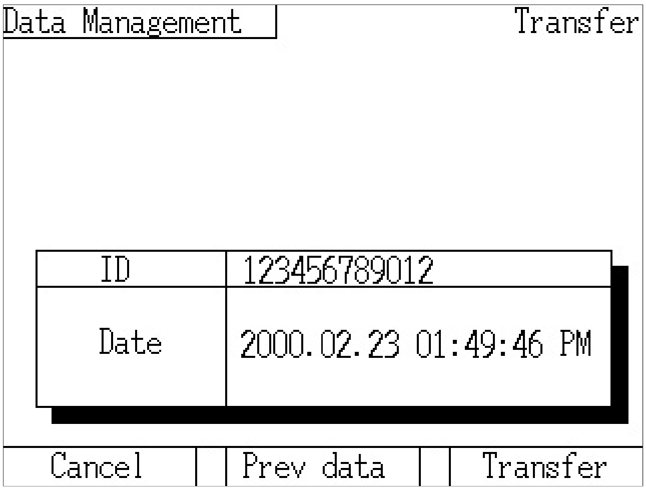
When a memory card formatted by an ECG-9130K cardiograph is used, up to three examination dates of the ECG data files which has the same ID number can be displayed.

If the selected ID number does not exist in the memory card, the “File not found” message appears.

If an ID number is not entered, the ECG data file which has no ID number is displayed.

To cancel transferring, press the F1 “Cancel” function key.
To select another file, press the F2 “Prev data” function key.

To select the latest ECG data file:
Press the F2 “Latest data” function key.

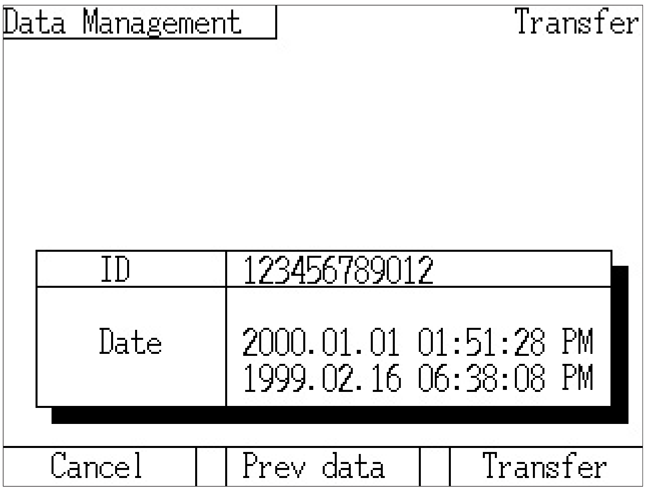


ID	123456789012
Date	2000.02.23 01:49:46 PM

To cancel transferring, press the F1 “Cancel” function key.
To select another file, press the F2 “Prev data” function key.

4. Press the F3 “Transfer” function key. When the selected file is transferred, the following screen is displayed.

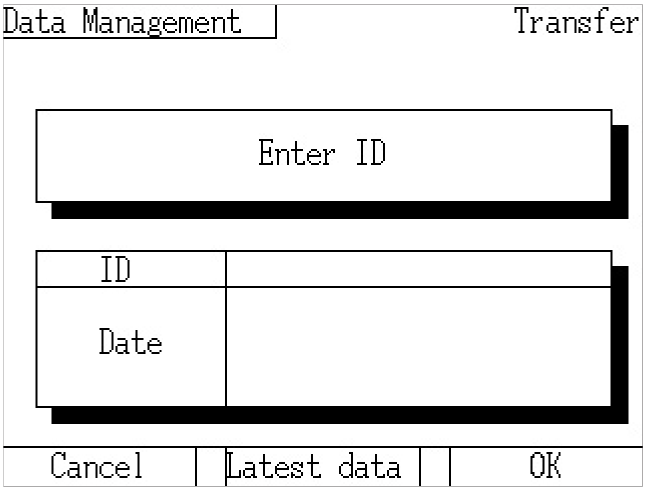
When the ECG data file is selected by the ID number:



ID	123456789012
Date	2000.01.01 01:51:28 PM 1999.02.16 06:38:08 PM

To transfer another file,
1) Select it with the F2 “ Prev data” function key.
2) Press the F3 “Transfer” function key.

When the latest ECG data file is selected:



4. Press the F1 “Cancel” function key. The Data Management - Enter ID screen is displayed.

   To return to the Data Management screen, press the F1 “Cancel” function key.

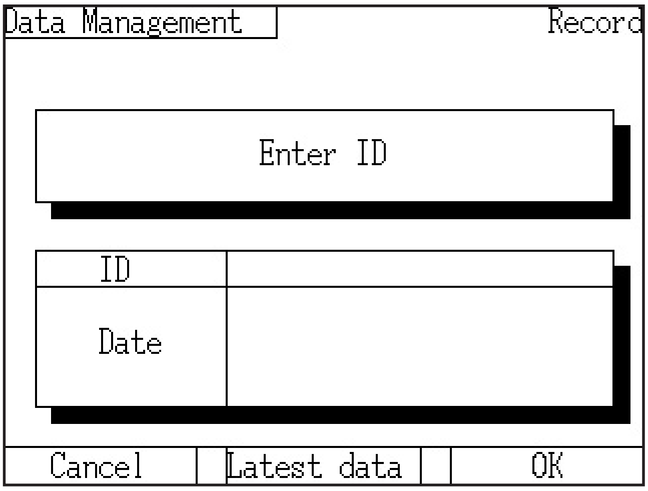
Recording the ECG Data in a Memory Card

An ECG data saved in a memory card can be recorded.

1. Call up the Data Management screen. Refer to the “Calling up the Data Management screen.”

2. Select “Record” with the F2 “NEXT” function key. “Record” is highlighted.

3. Press the F3 “OK” function key. The Data Management - Record screen is displayed.



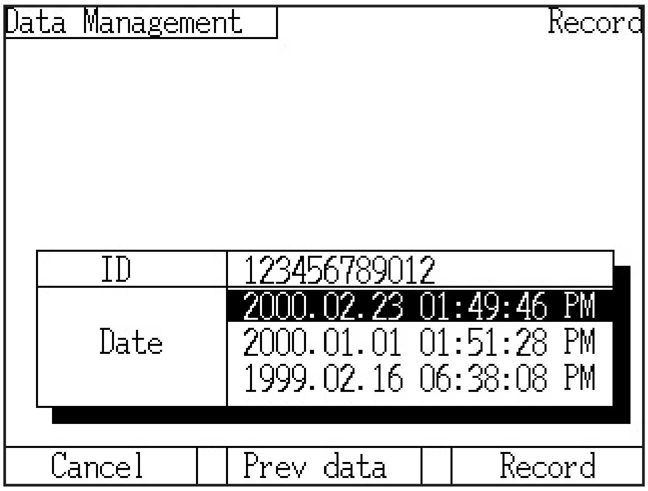
To return to the Data Management screen, press the F1 “Cancel” function key.

4. Do one of the following.

   To select the ECG data file by the ID number:

   1) Use the keyboard on the operation panel to enter the ID number of the ECG data file.

   2) Press the F3 “OK” function key. The ID number and examination date of the selected ECG data file are displayed.



ID 123456789012

Date
2000.02.23 01:49:46 PM
2000.01.01 01:51:28 PM
1999.02.16 06:38:08 PM

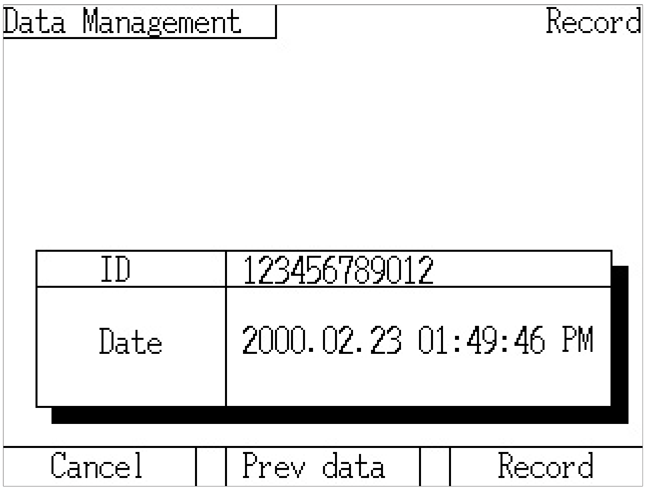
When a memory card formatted by an ECG-9130K cardiograph is used, up to three examination dates of the ECG data files which has the same ID number can be displayed.

If the selected ID number does not exist in the memory card, the “File not found” message appears.

If an ID number is not entered, the ECG data file which has no ID number is displayed.

To cancel transferring, press the F1 “Cancel” function key.
To select another file, press the F2 “Prev data” function key.

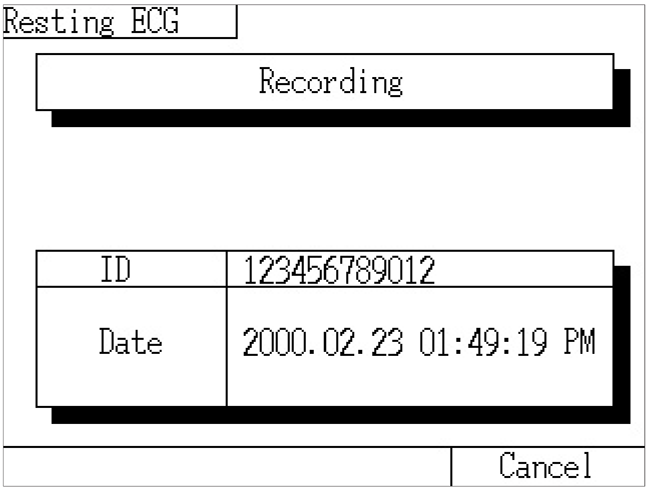
To select the latest ECG data file:
Press the F2 “Latest data” function key.



ID 123456789012
Date 2000.02.23 01:49:46 PM

To cancel recording, press the F1 “Cancel” function key.
To select another file, press the F2 “Prev data” function key.

5. Press the F3 “Record” function key. The cardiograph starts recording of the selected ECG data files.

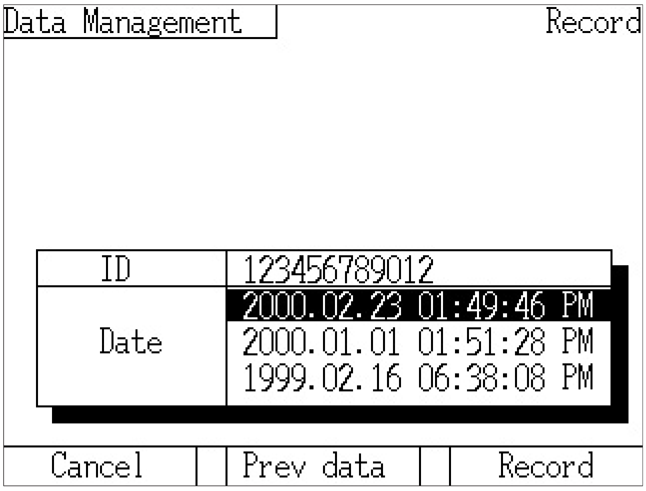


Recording

ID 123456789012
Date 2000.02.23 01:49:19 PM

When the selected file is recorded, the following screen is displayed.

When the ECG data file is selected by the ID number:

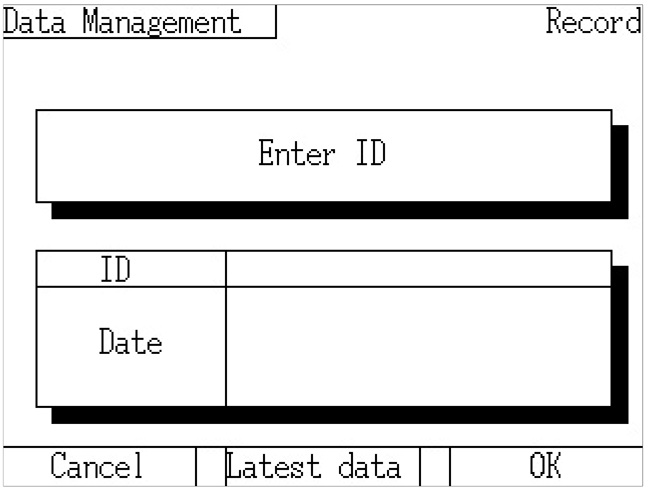


ID 123456789012
Date 2000.02.23 01:49:46 PM
2000.01.01 01:51:28 PM
1999.02.16 06:38:08 PM

To record another file,

1) Select it with the F2 “ Prev data” function key.
2) Press the F3 “Record” function key.

When the latest ECG data is selected:



6. Press the F1 “Cancel” function key. The Data Management - Record screen is displayed.

   To return to the Data Management screen, press the F1 “Cancel” function key.

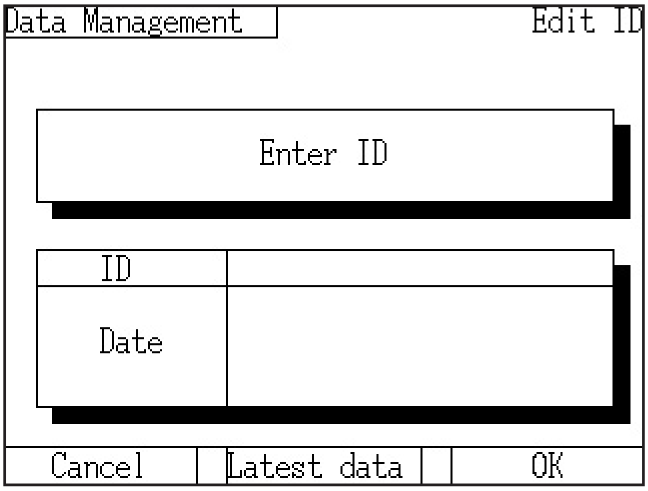
Changing the ID Number of an ECG Data File in a Memory Card

The ID number of an ECG data file in a memory card can be changed.

1. Call up the Data Management screen. Refer to the “Calling up the Data Management screen.”

2. Select “Edit ID” with the F2 “NEXT” function key. “Edit ID” is highlighted.

3. Press the F3 “OK” function key. The Data Management - Edit ID screen is displayed.



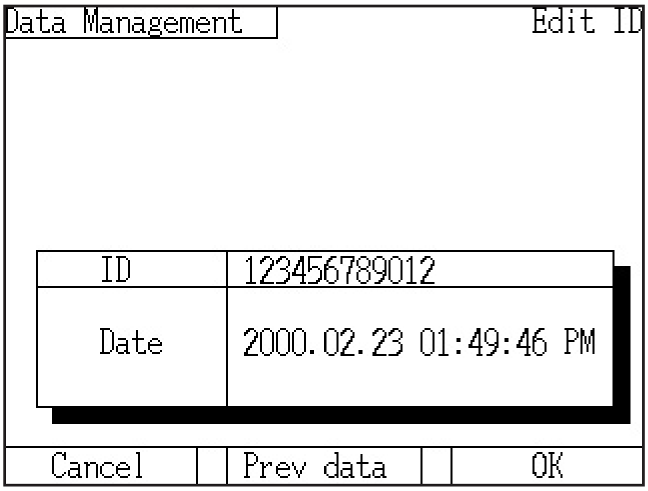
To return to the Data Management screen, press the F1 “Cancel” function key.

4. Do one of the following.

   To select the ECG data file by the ID number:

   1) Use the keyboard on the operation panel to enter the ID number of the ECG data file.

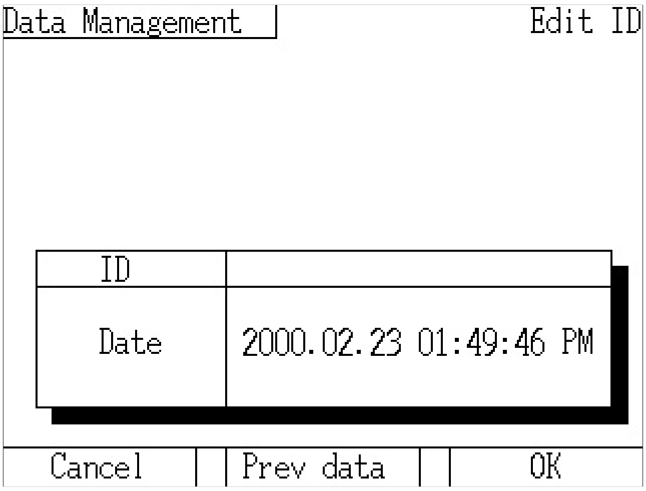
   2) Press the F3 “OK” function key. The ID number and examination date of the selected ECG data file are displayed.



ID	123456789012
Date	2000.02.23 01:49:46 PM

If the selected ID number does not exist in the memory card, the “File not found” message appears.

To select the ECG data file which has no ID number:
Press the F2 “Latest data” function key. When the memory card formatted by an ECG-9130K cardiograph is used, up to three examination dates of the ECG data files which have no ID number are displayed.

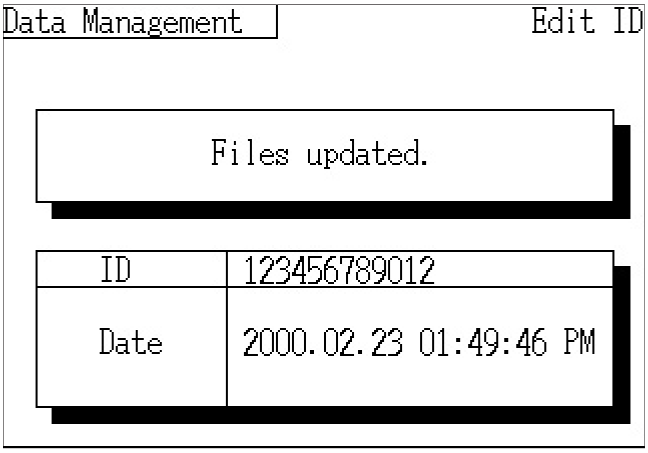


ID	
Date	2000.02.23 01:49:46 PM

To select a different file, press the F2 “Prev data” function key.

5. Enter the new ID number with the keyboard.

6. Press the F3 “OK” function key. The message “Files updated” message appears, then the Data Management - Edit ID screen is displayed.



Files updated.

ID	123456789012
Date	2000.02.23 01:49:46 PM

To cancel changing, press the F3 “Cancel” function key. The Data Management - Edit ID screen is displayed.

To change the ID number of another ECG data file, repeat steps 4 to 6.

7. Press the F1 “Cancel” function key. The Data Management screen is displayed.

Receiving an ECG Data File

The cardiograph can receive the ECG data files from another cardiograph or personal computer. The received ECG data is automatically recorded and not saved in a memory card.

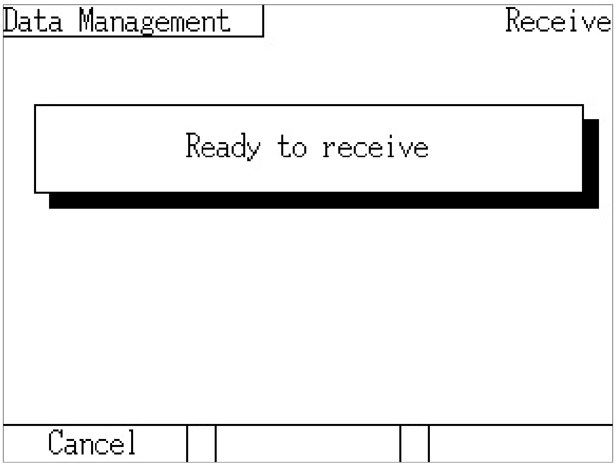
NOTE

- **The cardiograph can only manage the ECG-9000 Series Type 2 ECG data files.**
- **When receiving an ECG data file, set "Transfer Option" or "After receiving" in the communication settings of the connected cardiograph to "Print". If not, this cardiograph cannot receive the ECG data file.**

1. Call up the Data Management screen. Refer to the "Calling up the Data Management screen."

2. Select "Receive" with the F2 "NEXT" function key. "Receive" is highlighted.

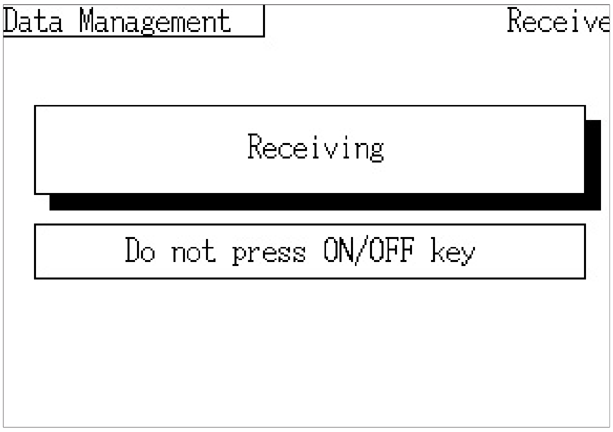
3. Press the F3 "OK" function key. The Data Management - Receive screen is displayed and the "Ready to receive" message appears.



Ready to receive

To return to the Data Management screen, press the F1 "Cancel" function key.

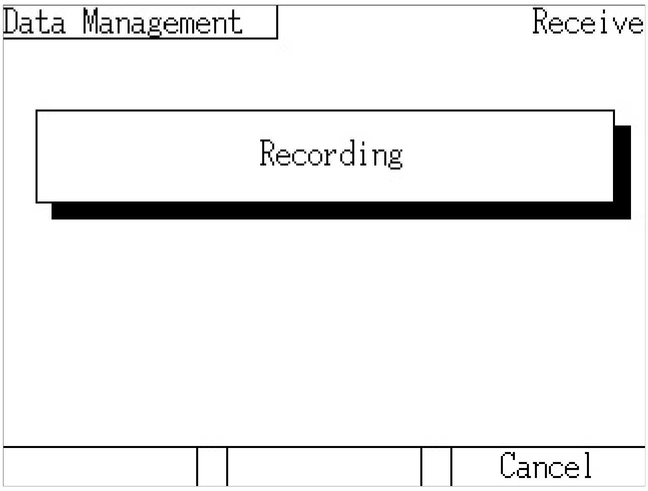
While receiving the ECG data file, the “Receiving / Do not press ON/OFF key” message appears.



Receiving

Do not press ON/OFF key

When the ECG data file receiving is complete, the “Recording” message appears and the received ECG data file is automatically recorded.



Recording

To cancel recording, press the F3 “Cancel” function key or the START/STOP key. The “Ready to receive” message appears.

After recording, the cardiograph can receive another ECG data file and the “Ready to receive” message appears.

4. Press the F1 “Cancel” function key. The Data Management screen is displayed.

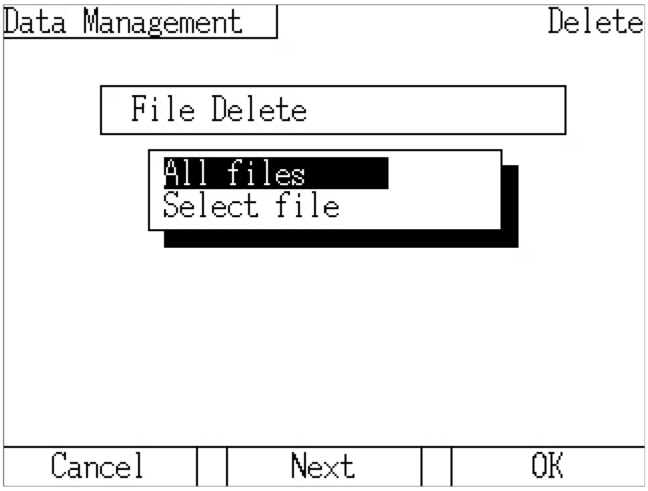
Deleting ECG Data Files

You can delete one or all ECG data files in the memory card.

1. Call up the Data Management screen. Refer to the “Calling up the Data Management screen.”

2. Select “Delete” with the F2 “NEXT” function key. “Delete” is highlighted.

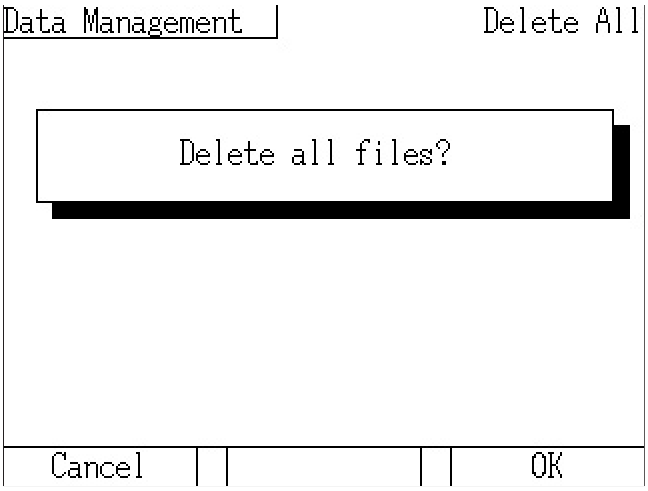
3. Press the F3 “OK” function key. The Data Management - Delete screen is displayed.



To return to the Data Management screen, press the F1 “Cancel” function key.

4. Do one of the following.
   To delete all ECG data files in the memory card.
   1) Select “All files” with the F2 “Next” function key. “All files” is highlighted.

   2) Press the F3 “OK” function key. The “ Delete all files?” message appears.

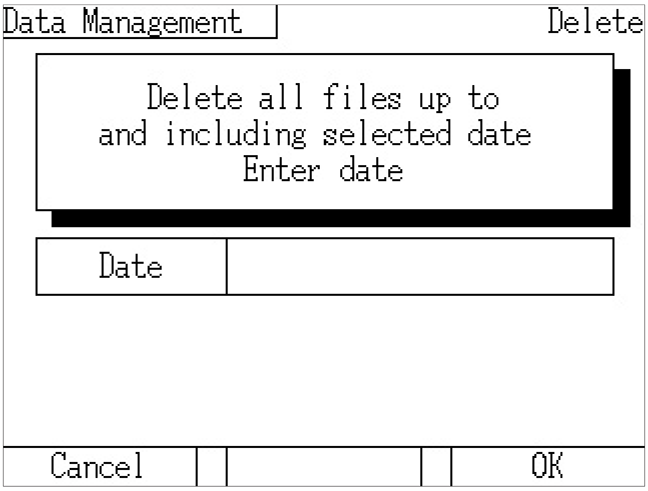


To cancel deleting, press the F1 “Cancel” function key. The Data Management screen - Delete is displayed.

To delete all ECG data files in the memory card up to the selected examination date:

1) Select “Select file” with the F2 “Next” function key. “Select file” is highlighted.

2) Press the F3 “OK” function key.

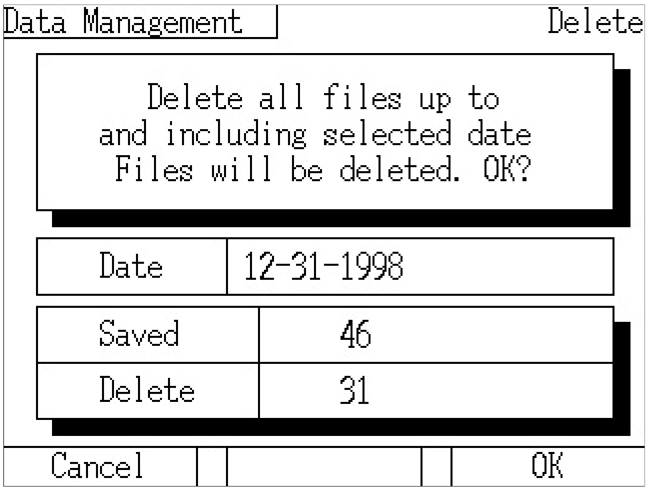


Delete all files up to
and including selected date
Enter date

Date	

3) Use the keyboard on the operational panel to enter the examination date.

4) Press the F3 “OK” function key. All ECG data files up to and including the selected examination date are searched for.



Delete all files up to
and including selected date
Files will be deleted. OK?

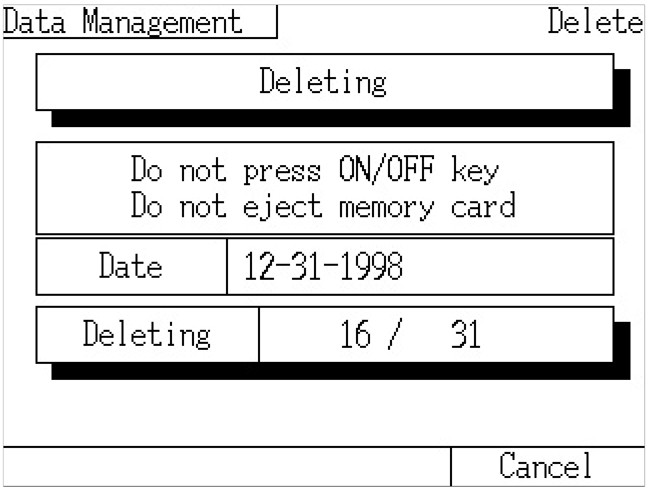
Date	12-31-1998

Saved	46
Delete	31

Saved: Total number of files saved in a memory card.
Delete: Number of files which will be deleted.

To cancel deleting, press the F1 “Cancel” function key. The Data Management screen- Delete is displayed.

5. Press the F3 “OK” function key. All selected files are deleted.



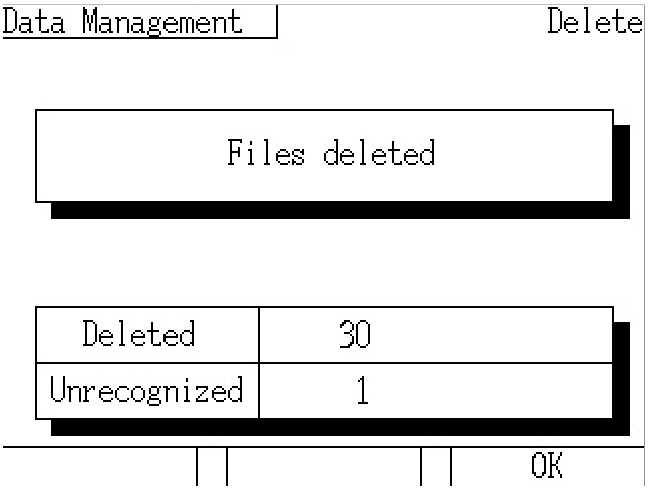
Deleting

Do not press ON/OFF key
Do not eject memory card

Date	12-31-1998
Deleting	16 / 31

To cancel deleting, while deleting the ECG data files, press the F3 “Cancel” function key. After the current ECG data file is deleted, the deleting operation is canceled and the “Abort” message appears. Press the F3 “OK” function key. The Data Management - Delete screen is displayed.

6. When all selected files are deleted, the “Files deleted” message appears. Press the F3 “OK” function key. The Data Management screen is displayed.



Files deleted

Deleted	30
Unrecognized	1

Unrecognized: Number of files which the cardiograph cannot manage.

Formatting the Memory Card

CAUTION

- **Use only the QM-040V memory card.**
- **Format the memory card before the first use.**
- **Format the memory card only in an ECG-9130K or ECG-9320A/K cardiograph. Memory cards formatted in other ECG models cannot be used in this cardiograph.**
- **Do not press the memory card eject button or turn the power off while data is being written to or read from the card. Otherwise, the memory or saved data may be damaged.**
- **Formatting deletes all saved data in the memory card.**

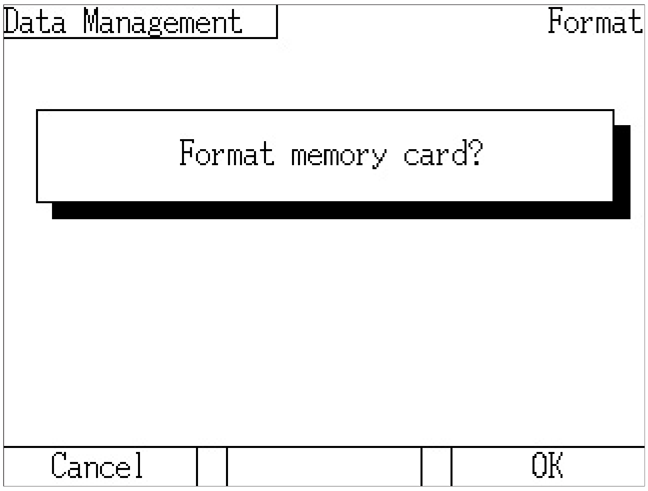
---

1. Insert the memory card into the memory card slot on the right side panel.

2. Call up the Data Management screen. Refer to the "Calling up the Data Management screen."

3. Select "Delete" with the F2 "NEXT" function key. "Format" is highlighted.

4 Press the F3 "OK" function key. The Data Management - Format screen is displayed.

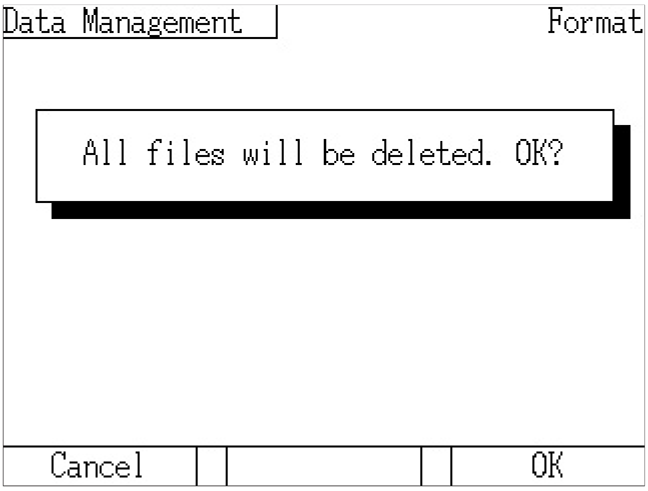


Data Management

Format

Format memory card?

5 Press the F3 "OK" function key. The "All files will be deleted. OK?" message appears.

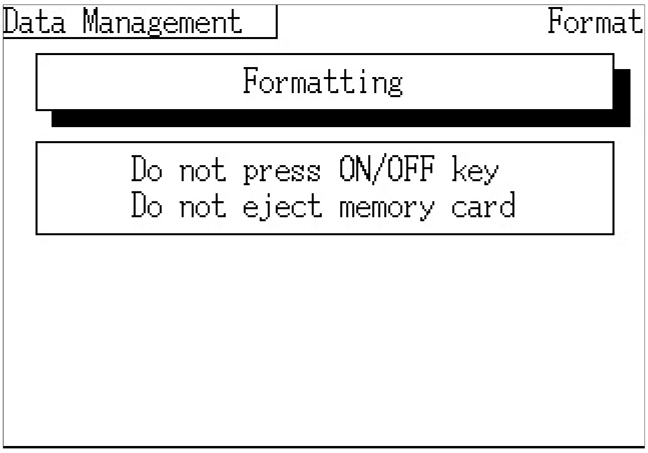

Data Management

Format

All files will be deleted. OK?

6 Press the F3 “OK” function key. The cardiograph starts formatting the memory card.

To cancel formatting, press the F1 “Cancel” function key. The Data Management screen is displayed.

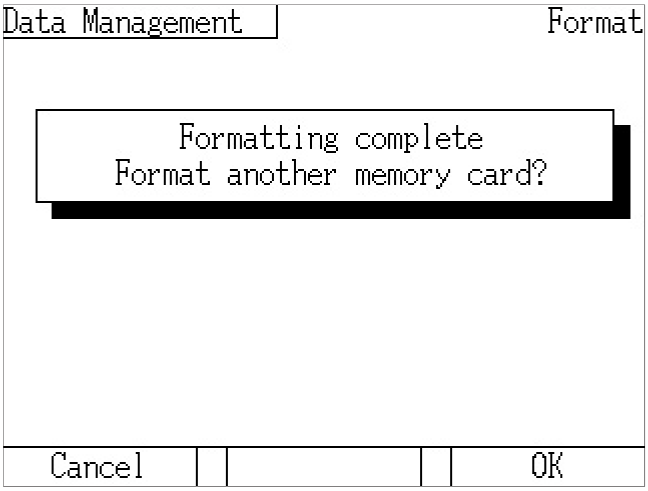

Data Management

Format

Formatting

Do not press ON/OFF key
Do not eject memory card

7. When the formatting is complete, the following screen is displayed.
To format another memory card, press the F3 “OK” function key.
To call up the Data Management screen, press the F1 “Cancel” function key.


Data Management

Format

Formatting complete
Format another memory card?

Recording the File List in a Memory Card

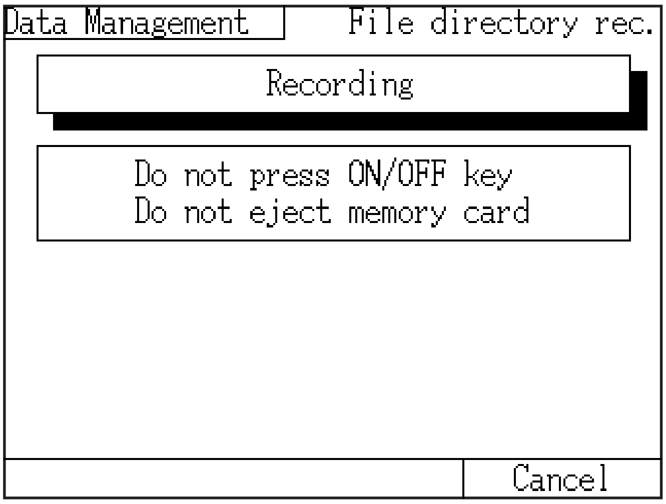
The cardiograph can record the patient information for each patient in a memory card as a file list. Only the list for the resting ECG waveform recording is available.

1. Insert the memory card into the memory card slot on the right side panel.

2. Call up the Data Management screen. Refer to the "Calling up the Data Management screen."

3. Select "File directory rec." with the F2 "NEXT" function key. "File directory rec." is highlighted.

4 Press the F3 "OK" function key. The patient information for each data is recorded chronologically.



Recording

Do not press ON/OFF key
Do not eject memory card

To cancel recording, press the F3 "Cancel" function key.

Recording example

1	1945	F	36Y	Sep 18. 2001	10:01	AM
2	1946	M	40Y	Oct 10. 2001	9:00	AM
3	1947	F	60Y	Nov 15. 2001	2:15	PM
4	1948	M	35Y	Nov 15. 2001	3:00	PM
-						

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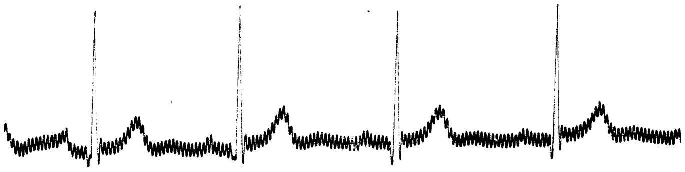
Section 9 Troubleshooting and Error Messages

Recording Clear ECG Waveforms 9.1
  AC Interference 9.1
  Muscle Tremor Interference (EMG) 9.1
  Wandering Baseline 9.2
  Other 9.2
Troubleshooting 9.3
Error Messages 9.7
System Information and Error History 9.10
Checking the Software Version 9.11

Recording Clear ECG Waveforms

AC Interference

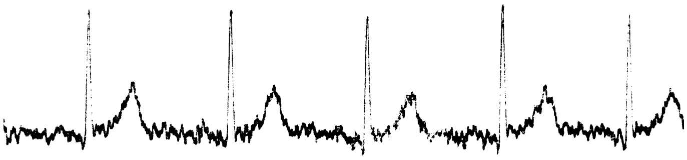
Appears on the ECG as even-peaked, regular voltages superimposed throughout the tracing. It may appear in conjunction with muscle tremor.



Causes:
- Dirty or corroded lead wire tips or electrodes
- Loose electrode connection
- Patient or technician touching an electrode during recording
- Patient touching any metal part of a bed or examination table
- Broken lead wire, patient cable or power cord
- Electrical devices in the immediate area, lighting, concealed wiring in walls or floors
- Improperly grounded electrical outlet

Muscle Tremor Interference (EMG)

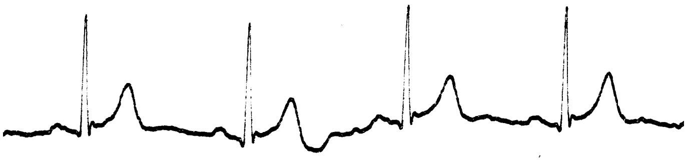
Appears on the ECG as random, irregular voltages superimposed on the tracing. It may resemble or occur in conjunction with AC interference.



Causes:
- Patient is uncomfortable, tense, nervous or apprehensive
- Patient is cold and shivering
- Patient has a neuro or muscular disorder (e.g.. Parkinson’s Disease)
- Examination table or bed is too narrow or short to support limbs comfortably
- Limb electrode straps are too tight

Wandering Baseline

Appears on the ECG as a fluctuation of the tracing up and downward on the grid.



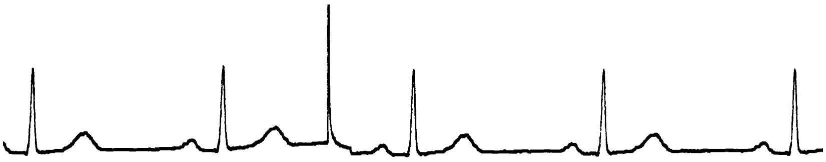
Causes:
- Dirty or corroded electrodes
- Loose electrodes or electrodes positioned on a bony area
- Insufficient or dried out CardioCream
- Oily skin or body lotions and creams
- Rising and falling of chest during normal or apprehensive respiration

When wandering baseline occurs,
- Clean skin with alcohol or acetone if necessary.
- Reposition electrodes.
- Check the electrode connections.
- Assist patient in relaxation.

Other

When an electrosurgical unit (ESU) is used with the cardiograph, noise generated by an ESU is superimposed on the ECG waveforms.

Equipment in the same room as the cardiograph may generate noise which is superimposed on the ECG waveforms.
- Noise generated by an electrosurgical unit
- Noise from AC power line
- Spike noise caused by electrostatic energy as shown below



NOTE

The baseline becomes flat for a while after defibrillation to protect the cardiograph.

Troubleshooting

When trouble occurs, take quick action referring to the table below. If there is any damage or the cardiograph is suspected to be faulty as a result of checking, turn the power off, attach an “Unusable” or “Repair request” label to the cardiograph and contact your Nihon Kohden distributor or representative.

Trouble	Action
When the power switch is pressed, the cardiograph does not operate on AC power (The power lamp is not lit).	Check that the power cord is firmly connected to the cardiograph and AC outlet.
When the power switch is pressed, the cardiograph does not operate on battery power (The power lamp and battery operation lamp are not lit).	1. Check that the battery is inserted in the cardiograph correctly. 2. Check the battery. If it is almost discharged, operate the cardiograph on AC power or recharge the battery. If the remaining battery operation time is less than 30 minutes, replace it with a new one.
Nothing can be recorded.	1. Check that the recording paper is set correctly. If the “Check paper or recorder” message appears and alarm sounds, there is no recording paper. Correctly set the recording paper. 2. Check that the magazine is firmly closed. 3. If the START/STOP lamp is not lit, press and hold down the START/STOP key until the lamp is lit.
During battery operation, the power is lost during recording.	• Check the battery. If it is almost discharged, operate the cardiograph on AC power or recharge the battery. If the remaining battery operation time is less than 30 minutes, replace it with a new one. • The power is automatically turned off to save the battery power. Press the POWER switch to resume operation. Refer to “Automatic power off” in “AC Operation and Battery Operation” of Section 1.
The power is lost during recording on either AC or battery operation.	Check the internal memory with “Memory test” in the system test. If the memory is faulty, contact NK distributor or representative. If the memory is not faulty, power loss might be caused by static electricity. Keep the cardiograph away from materials which generate electrostatic discharge such as curtains.

Trouble	Action
No ECG waveform can be recorded even when the electrodes are attached to the patient correctly.	1. Check the continuity of the patient cable with "Input unit test" in the system test. 2. Check that the electrodes are clean. If an electrode is contaminated with electrolyte cream (CardioCream), the ECG waveform cannot be recorded due to high skin-electrode contact impedance. Wash the electrodes to remove dirt or contamination. 3. If a new and old electrode, or a reusable and disposable electrode are used together, the ECG waveform cannot be recorded due to high polarization voltage. Do not use different types or ages of electrodes together. 4. If a disposable electrode is used more than once, the ECG waveform cannot be recorded due to polarization voltage. Use only new electrodes.
Analysis result recording cannot be performed.	1. If the recording time is less than 10 seconds, the cardiograph does not analyze the acquired ECG waveform. Record the ECG waveform at least 10 seconds. 2. When the printed heart rate is "***", the cardiograph did not detect the QRS waves because the amplitude of lead II, V1 and V5 lead are too small. Always check that the heart rate correctly appears on the screen before pressing the START/STOP key.
Recording result is partially missing or thin.	When the thermal head is touched with a dirty hand, or comes in contact with CardioCream or physiological saline solution, this causes missing dots on the recording or reduces recording intensity. Clean the thermal head with the thermal head cleaner. Take care not to touch the thermal head with a dirty hand when setting the recording paper.
Paper skews as it feeds	1. Set the recording paper straight by aligning it with the paper guide. 2. When the thermal head is dirty, the recording paper may skew. Clean the thermal head with the thermal head cleaner.
The screen is not bright and the waveform cannot be read.	Adjust the screen contrast. Refer to "Adjusting the screen contrast" in Section 2.
The time and date is not correct.	Replace the built-in lithium battery. The life time of the battery is about 7 years.

Trouble	Action
The power is not turned off by pressing the POWER key.	Press and hold the POWER key for more than 5 seconds. This is a failure in the cardiograph. Attach an "Unusable" or "Repair request" label to the cardiograph and contact your Nihon Kohden distributor or representative.
The System information and "Error 05" is printed when the power is turned on.	Any key is pressed and held for more than 15 seconds. If this error occurs every time the power is turned on, any key has a short circuit. Contact your Nihon Kohden distributor or representative.

Recording a File List

Trouble	Cause	Action
Cannot record the patient file list	Memory card is not inserted.	Insert a memory card which has resting ECG waveform data. The patient file list other than the resting ECG waveform recording is not available.
	Resting ECG waveform data is not saved in the memory card.	
	No recording paper.	Set the recording paper.
The ECG waveform data in the file list cannot be recorded or searched for.	Another memory card is inserted.	Insert the memory card corresponding to the patient file list.
	Trying to record the patient file list with a memory card from an instrument other than an ECG-9130K or ECG-9320A/K cardiograph.	Only a memory card which is formatted and saved with an ECG-9130K or ECG-9320A/K cardiograph can be used.
	Resting ECG waveform data is not saved in the memory card.	Insert a memory card which has resting ECG waveform data.
	No recording paper.	Set the recording paper.

Error Messages

When an error message is displayed on the screen, take quick action referring to the table below.

Instrument

Error message	Cause	Action
Fail	• Indicated electrode is detached or a large polarization voltage is detected. • If two or more limb electrodes are disconnected or the RF electrode is disconnected, no electrode is indicated in the error message area.	Check the electrode attachment of the indicated position.
Noise	• Noise superimposed on the indicated electrode waveform. • If noise overlaps on two or more limb electrodes, or RF electrode, no electrode is indicated in the error message area.	Check the electrode attachment of the indicated position.
Check paper or recorder	1. No recording paper. 2. The magazine is not closed firmly.	1. Set the recording paper. 2. Push the magazine in until it is fixed firmly.
Charge Battery	Battery is discharged.	Operate the cardiograph on AC power or charge the battery.

Filing and Communication

Error message	Cause	Action
Insert memory card	A memory card is not inserted in the memory card slot, or it has been inserted incorrectly.	Insert the memory card into the memory card slot and try the procedure again.
Check memory card	An unspecified memory card is inserted.	Insert the specified memory card.
	The memory card was changed while doing a procedure.	Insert the correct memory card and try the procedure from the first step.
Cannot read memory card	The memory card may be damaged.	Replace the memory card with a new one.
File not found	No ECG data file is saved in the memory card.	———
Not enough free memory	There is no space to save new ECG data file in the memory card.	Transfer saved ECG data files to a PC or another cardiograph, or delete unnecessary ECG data files.
Cannot record the file	The recording paper is used up.	Set a new recording paper
	The paper feeding motor is faulty.	Contact your Nihon Kohden distributor or representative.
Invalid ECG data file	The ECG data file may be damaged.	Delete the ECG data file from the memory card.
	A different type of ECG data file is saved in the memory.	The cardiograph can only manage ECG-9000 Series Type 2 ECG data files.
Unsupported file type	The connected cardiograph tries to transfer an ECG data file with the communication setting “After receiving” set to “Save”.	Set the communication setting “After receiving” of the connected cardiograph to “Print”.
	The connected cardiograph or PC transfers a different type of ECG data file.	The cardiograph can only receive ECG-9000 Series Type 2 ECG data files.
	The connected cardiograph or PC transfers 160 KB or more of ECG data file.	The cardiograph can receive up to 160 KB of ECG data file at a time.

Filing and Communication - continued

Error message	Cause	Action
Check a modem	The power of the modem is not turned on.	Turn the power of the modem on.
	The modem is not connected to the cardiograph correctly.	Check the connection between the cardiograph and modem.
Line error	The PC or another cardiograph is not connected to the cardiograph correctly.	Check the connection between the PC or another cardiograph.
	The power of the PC or another cardiograph is not turned on.	Turn the power of the PC or another cardiograph on.
Line error (when a modem is used)	The destination telephone number set in the System setup screen is not correct.	Check and set the correct telephone number.
	The destination modem setting is not correct.	Check the destination modem setting.
Transfer error	The power of the destination modem, PC or cardiograph was turned off during communication.	Check that the power of the destination modem, PC or cardiograph is turned on.
	A connection cable was disconnected during communication.	Check all cables of the destination modem, PC or cardiograph.
Phone number not entered	The destination telephone number is not set.	Set the telephone number on the System Setup screen.
busy	The destination telephone is busy.	———

System Information and Error History

During power-up and operation the cardiograph continuously checks itself for system failure. If a failure is detected, system information and error history are printed on the recording paper and all operations are stopped. System information and error history are also printed due to transient noise. After printing the system information and error history, the power of the instrument is automatically turned off.

NOTE

If the same system information appears again after restarting the cardiograph, do not use the cardiograph until service personnel has corrected the cause of the problem. Sending a copy of the system information to your Nihon Kohden distributor or representative helps us to troubleshoot your problem quickly.

System Information

Indicates an error number to identify the problem. Refer to the Service manual.

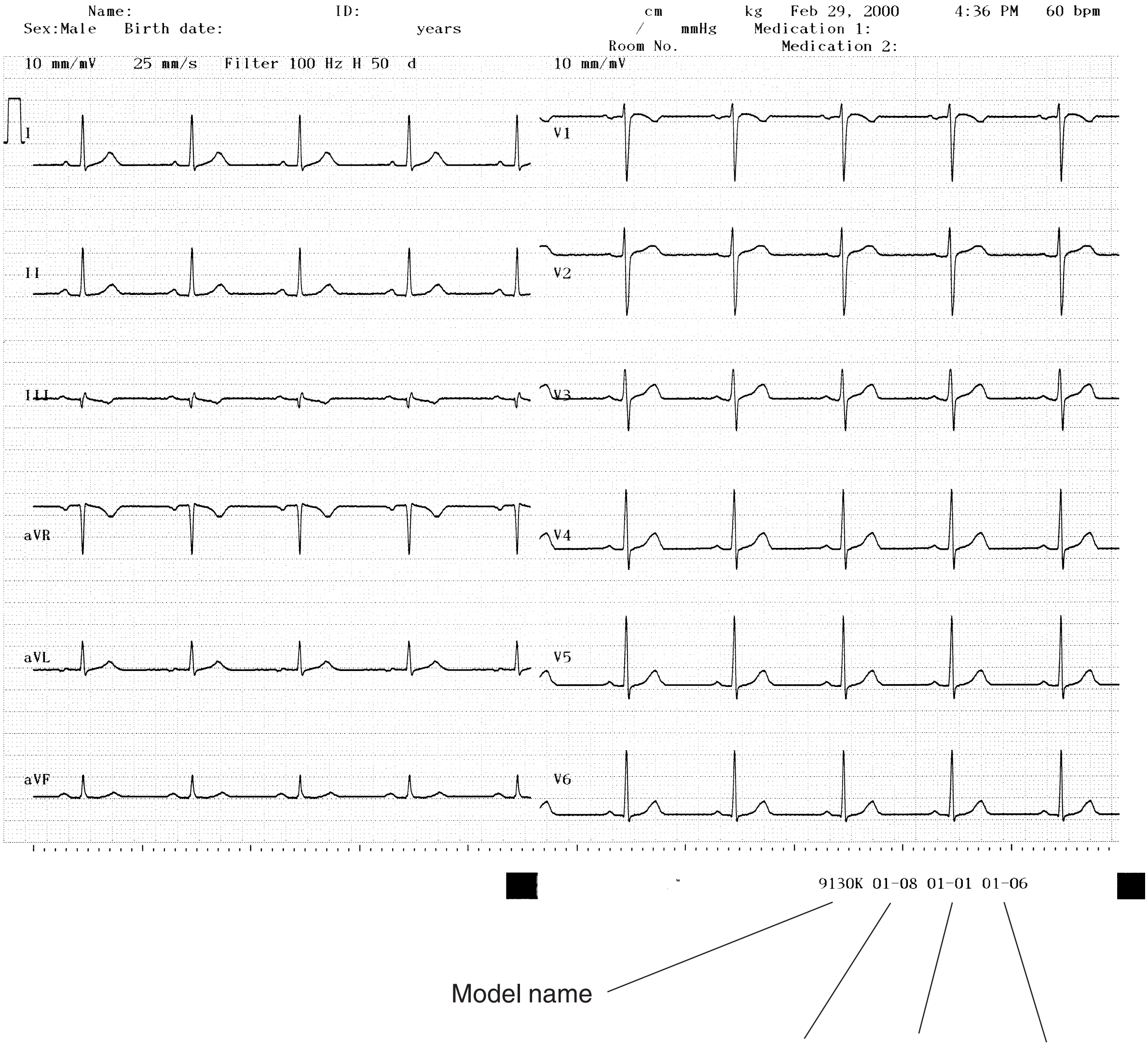
Error History

Indicates the latest three errors and the date of the latest error, as in the example below.

```
********** System Information **********

          Error number:    05
                           Filter

          Date:            Nov 26, 1998   9:38 AM
          Program:         9130K
          Version:         01-07  01-02  01-06

********** Error History **********
No.1      Error number:    05
          Date:            Nov 26, 1998  9:37 AM
No.2      Error number:    20
No.3      Error number:    01

NIHON KOHDEN Thu Nov 26, 9:38:11 JST 1998
```

Checking the Software Version

The software version numbers are also printed at the lower space of the paper in automatic or manual ECG recording.



```
Name:                          ID:                                          cm        kg   Feb 29, 2000      4:36 PM   60 bpm
Sex:Male   Birth date:                          years                   /    mmHg    Medication 1:
                                                                     Room No.          Medication 2:
10 mm/mV    25 mm/s   Filter 100 Hz H 50   d                     10 mm/mV
```

```
9130K 01-08 01-01 01-06
```

Model name

Software version: System, Input unit, ECG analysis

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Section 10 Maintenance and System Test

Maintenance 10.1
    Check Items After Use 10.1
Cleaning 10.2
    Clean the Cardiograph 10.2
    Cleaning the Electrode and Tips of the Patient Cable 10.2
    Cleaning the Thermal Head 10.3
    Checking the Patient Cable 10.3
Periodical Replacement Schedule 10.4
System Test 10.5
Repair Parts Availability Policy 10.5

Maintenance

Check Items After Use

After use, check the following items for the next use.

After turning the power off

Overview:

- Cardiograph is not dirty, damaged or in contact with liquid.
- No peeling or tear in the operation panel.
- No key is broken.
- Electrodes are clean and not damaged.
- Power cord is not damaged.
- Cable hanger is not damaged.
- Paper magazine is not damaged.

Accessories:

- Enough electrolyte cream
- Enough recording paper
- Enough disinfected or sterilized dry electrodes
- Patient cable is not frayed or damaged
- No cracks in the rubber of suction electrodes.

Storage:

- Electrodes are washed.
- The battery is fully recharged.
- The thermal head is clean.
- The power is turned off.
- No chemicals or water are near the cardiograph.
- Acceptable storage temperature and humidity

Cleaning

CAIUTION

- **Do not rub hard over the lettering.**
- **Do not use solvents or detergents for cleaning.**
- **Do not use organic solvents such as thinner, benzene, or industrial alcohol. These damage the cardiograph, patient cable and electrodes.**
- **Before cleaning, turn the power off and disconnect the AC power cord from the cardiograph.**
- **The "CAUTION LABEL" contains important information for operating the cardiograph.**
  Clean the label if it is dirty. If the label is damaged or difficult to read, contact your NK distributor or representative to replace it with a new one.

Clean the Cardiograph

Before or after use:

To remove dirt, clean the exterior surface of the cardiograph with a soft cloth.

If the patient cable connector is dirty, clean it with a soft cloth.

Cleaning the Electrode and Tips of the Patient Cable

CAUTION

Do not wash the electrodes with any abrasive. Scratches on the surface of the electrodes may cause inaccurate ECG recording due to high skin-electrode contact impedance.

After use:

1. Completely remove electrolyte cream (CardioCream) from the electrode surfaces.

2. Wash the electrodes with soap and warm water.

3. Thoroughly dry electrodes with a dry, soft cloth.

Cleaning the Thermal Head

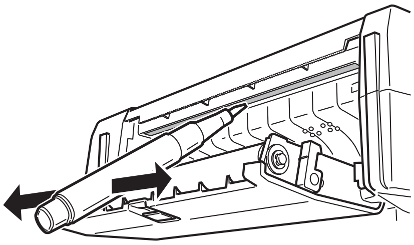
CAUTION

Before cleaning, turn the power off and disconnect the AC power cord from the cardiograph.
Do not clean the thermal head just after recording because the head is still hot.

Before setting the recording paper, clean the thermal head with the thermal head cleaner. If the thermal head is dirty, printing quality is reduced.

When used for a log time, the thermal head may become dirty. If the thermal head surface is touched with a dirty hand or if the recording paper is contaminated with chlorides (CardioCream or physiological salt solution), these will bemissing dots on the recording. In this case, the thermal head requires cleaning.

Wipe the head section (copper color) behind the paper cutter with the thermal head cleaner.



If the wheel gears are dirty, clean the gears with cotton moistened with alcohol.

Checking the Patient Cable

Periodically check the patient cable. Refer to “System Test” in Service Manual.

Periodical Replacement Schedule

To maintain the performance of the cardiograph, the following parts must be periodically replaced by qualified service personnel.

Built-in battery **After one year**

When the battery gets deteriorated, the battery operation time is below 30 minutes after 6 hours charging. Replace the battery with a new one.

LCD **After 15,000 hours**

When the LCD gets deteriorated, the screen display becomes darker. The above time is when the initial screen brightness is reduced to half.

Built-in lithium battery **After 7 years**

This battery backs up system setup and system clock. When the battery power is low, the time is not accurately recorded and the system setup restores to the default factory settings.

Thermal head **After 30 km continuous recording**

When the thermal head wears out, the recording density gets weaker due to missing dots.

Feeder motor **After 1,000 hours continuous operation**

When the motor wears out, the recording paper may be fed unevenly or at unstable speed.

For inspection and replacement of the above parts, consult your NK distributor or representative.

System Test

The cardiograph provides the following test items to check the operation manually. For detailed explanation, refer to the Service Manual.

- Recorder
- Thermal head
- Recording resolution setting
- Key
- Memory (single)
- Memory (continuous)
- LCD/LED
- Input unit
- Calibration
- Communication
- CRO/EXT1, 2
- System Setup Initialization

Repair Parts Availability Policy

Nihon Kohden Corporation (NKC) shall stock repair parts (parts necessary to maintain the performance of the instrument) for a period of 8 years from the date of delivery. In that period NKC or its authorized agents will repair the instrument. This period may be shorter than 8 years if the board or part necessary for the faulty section is not available.

Section 11 Reference

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Standard Accessories 11.4
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Specifications

ECG input

Input impedance	10 MΩ or more
Electrode offset tolerance	±500 mV or more
Input unit protection	Isolated and defibrillator protected only when the following specified patient cable is connected Patient cable: BJ-901D, BJ-902D, BJ-903D, BA-901D, BA-903D
Standard sensitivity	10 mm/mV ±2%
Common mode rejection ratio	100 dB or more
Frequency response	0.05 to 150 Hz –3 dB or more

Waveform data processor

Sample rate	500 samples/s (input unit: 8,000 samples/s)
AC line filter	50/60 Hz
High-cut filter	75, 100, 150 Hz
EMG filter	25/35 Hz
Time constant	3.2 s or more
Waveform status detection	Electrode detachment (polarization voltage), Noise (high frequency)

LCD (monochrome with CCFT backlight)

Size	5.6 inch
Number of dots	320 × 240
ECG waveform	2.8 seconds simultaneous 12 lead ECG waveforms
Displayed data	Waveform, patient information, recording settings, operation mode, heart rate, QRS sync mark, error message, electrode detachment, noise, patient information, hospital name

Recorder

Printing method	High resolution thermal printer head
Printing density	200 dpi (8 dots/mm)
Scanning line density	1 ms
Recording width	210 mm
Number of recording channels	3, 4, 6, 12
Sensitivity selection	Manual recording: 2.5, 5, 10 , 20 mm/mV Automatic recording:1.25, 2.5, 5, 10 , 20 mm/mV Sensitivity is automatically selected in automatic recording.
Paper speed	5, 10, 12.5, 25, 50 mm/s
Printed data	Program type, version, date and time, paper speed, sensitivity, lead name, filter, hospital name, patient information, timing mark, event mark, electrode detachment, noise, reset mark
Mechanical noise	48 dB or less at paper speed 25 mm/s

External input/output

External input	10 mm/0.5 V ±5%, input impedance 100 kΩ or more, 2 channel	
Signal output	0.5 V/1 mV ±10%, output impedance 100 Ω or less	
Serial I/O	Communication method:	RS-232C
	Baud rate:	2400, 4800, 9600, 19200, 38400, 57600, 115200

Power requirement

Line voltage	100 to 127V, 220 to 240V AC ±10%	
Line frequency	50 or 60 Hz	
Power input	Up to 150 VA	
Power consumption	60 W or less	
Built-in battery	Voltage:	12 V
(LCT-1912ANK)	Current consumption:	8A or less
	Battery operation time:	Approx. 30 minutes

Environment

Operating temperature	10 to 40°C (50 to 104°F)	
Operating humidity	25 to 90% RH	
Operating atmospheric pressure	70 to 106 kPa	
Storage duration and temperature	2 weeks or less:	–20 to 60°C (–4 to 140°F)
(Depends on the battery)	Between 2 weeks and one year:	–15 to 40°C (5 to 104°F)
	Over one year:	–15 to 25°C (5 to 77°F)
Storage humidity	15 to 95% RH (non condensing)	
Storage atmospheric pressure	70 to 106 kPa	
Recording paper storage temperature	–20 to 50°C (–4 to 122°F)	
Recording paper storage humidity	25 to 80% RH	
Electromagnetic compatibility	IEC 60601-1-2 CISPR11 Second Edition 1990-1999 Group 1 Class B IEC-1000-3-2 Class D 50 W (harmonic current emissions)	
Other	Indoor portable	

Dimensions and weight

Dimensions	240 W × 104 H × 324 D mm (excluding protrusions)
Weight	Approx. 4.9 kg (with battery) Approx. 4.2 kg (without battery)

Safety

Safety standard:

IEC 60601-1 (1988), IEC 60601-1 Amendment 1 (1991),
IEC 60601-1 Amendment 2 (1995), IEC 60601-2-25 (1993),
IEC 60601-2-25 Amendment 1 (1999)

Type of protection against electric shock:

AC power:	Class I
Battery power:	Internally powered equipment

Degree of protection against electric shock:

Defibrillator proof type CF applied part when patient cable BJ-901D, BJ-902D or BJ-903D is used

Degree of protection against harmful ingress of water:

Ordinary equipment

Degree of safety of application in the presence of a flammable anaesthetic mixture with air, oxygen or nitrous oxide:

Not suitable for use in the presence of a flammable anaesthetic mixture with air, oxygen or nitrous oxide

Mode of operation:

Continuous

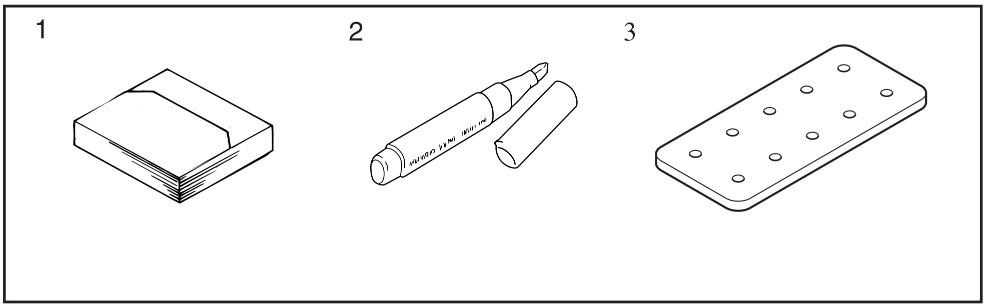
Performance

Performance standard: IEC 60601-2-51 (2003)

Standard Accessories

NOTE

When ordering the following accessories/consumables, specify the supply code no. When the supply code no. is not provided with the accessory, specify the code no.



For All Countries exept for Canada, China and U.S.A.

No.	Description	Q'ty	Code No.	Supply Code No.
1	Recording paper FQW210-3-140	1	551841	-
2	Thermal head cleaner	1	404617	Y001
3	Input check jig	1	6114-092972A	-
4	Power fuse	2	273999	-

For the fuse replacement, refer to Service manual.

For Canada and U.S.A.

No.	Description	Q'ty	Code No.	Supply Code No.
1	Recording paper FQW210-3-140	1	551841	-
2	Thermal head cleaner	1	404617	Y001
3	Input check jig	1	6114-092972A	-
4	Power fuse	2	273999	-
5	Power cord, Type UL	1	505312	L943
6	Patient cable, BA-903D	1	6143-008724A	K020
7	Battery LCT-1912ANK	1	332543B	X041A

For the fuse replacement, refer to Service manual.

For China

No.	Description	Q'ty	Code No.	Supply Code No.
1	Recording paper FQW210-3-140	1	551841	-
2	Thermal head cleaner	1	404617	Y001
3	Input check jig	1	6114-092972A	-
4	Power fuse	2	273999	-
5	Power cord, Type GB	1	4843415	-
6	Ground lead, Type D	1	098029	L912
7	Patient cable, BJ-901D, IEC 3 mm φ tip	1	6143-008288D	K079
8	Chest electrode, 3 mm φ tip, for adult, 3 pcs/set	2	6144-000427B	H041
9	Clip-on limb electrode, 3 mm φ tip, 4 pcs/set, Fastclip	1	2144-005553B	H068
10	Battery LCT-1912ANK	1	332543B	X041A
11	Cardio Cream, 30g	1	276104B	F010

For the fuse replacement, refer to Service manual.

Options

Accessory Kit

YD-901D:	220-240V, IEC ECG lead (3 mmϕ)
YD-902D:	110-127V, IEC ECG lead (3 mmϕ)
YD-903D:	110-127V, AHA ECG lead (3 mmϕ)
YD-906D:	220-240V, IEC ECG lead (4 mmϕ)

Name	Q'ty	Code No. (/pcs)	Supply Code No.	YD-901D	YD-902D	YD-903D	YD -906D
Patient cable,							
BJ-901D, IEC 3 mmϕ tip	1	6143-008288D	K079	V	V		
BJ-902D, IEC/DIN 4 mmϕ tip	1	6143-008706B	K081				V
BA-901D, AHA 3 mmϕ tip	1	6143-008733A	K019			V	
Power cord,							
Type H	1	186656A	L935		V	V	
Type N	1	314839B	L936	V			V
Chest electrode, 3 mmϕ tip, for adult, 3 pcs/set	2	6144-000427B	H041	V	V	V	
Chest electrode, 4 mmϕ tip, for adult, 3 pcs/set	2	6144-001881B	H043				V
Clip-on limb electrode, 3 mmϕ tip, 4 pcs/set, Fastclip	1	2144-005553B	H068	V	V	V	
Clip-on limb electrode, 4 mmϕ tip, 4 pcs/set, Fastclip	1	2249-002027C	H068K				V
Battery LCT-1912ANK	1	332543B	X041A	V	V	V	V
Cardio Cream, 30g	1	276104B	F010	V	V	V	V

Cart KC-010A, KD-010A, KD-104E

CAUTION

Use only the KC-010A, KD-010A or KD-104E Cart for the cardiograph. When another cart is used, the cardiograph may fall off or the cart may tip over.

Patient cable hanger KH-801E

Used to attach the patient cable and electrode leads. This hanger prevents the cable or leads from getting tangled.

Patient cable BJ-903D, BA-903D

Provides IEC/DIN or AHA color clips for disposable electrode.

BJ-903D: IEC/DIN clip	(Code No.:6143-008715A, Supply code No.: K082)
BA-903D: AHA clip	(Code No.:6143-008724A, Supply code No.: K020)

Data Filing Software, ECG Viewer II QB-903E

MS Windows® based software which lets you use a PC to store and manage data acquired by the cardiograph.

Connector Pin Assignment

CAUTION

- **When connecting an external instrument to the connectors marked with ⚠, ensure that the external instrument complies with the IEC 60601-1 safety standard for medical equipment or CISPR 11 Section Edition 1990-09, Group 1 and Class B standard. When the external instrument does not comply with either of these standards, use a locally available medical use isolation transformer unit between the external instrument and the AC outlet.**
- **When the cardiograph operates on battery power and large leakage current is input from the connected external instrument, ground the cardiograph or use an isolation transformer for the external instrument. Failure to follow this caution may cause electrical shock to patient and operator.**

Attaching the Ferrite Core

NOTE

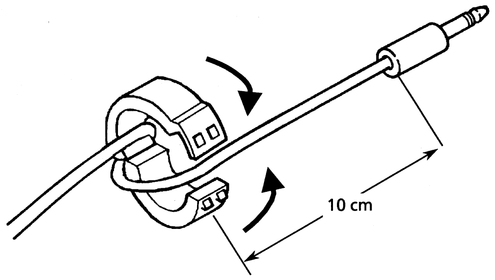
When connecting an external instrument to the following connectors, an unwanted radio frequency signal is generated from this connection. To reduce this unwanted radiofrequency signal, attach the optional ferrite core to the cable of the external instrument.

Connector	Ferrite Core Model	Wrapping Requirement	Code No.
EXT-IN 1,2	RI-14-28-6	Wrap the cable once around the ferrite core	493182
CRO-OUT	RI-14-28-6	Wrap the cable once around the ferrite core	493182
SIO	SEC-8	Not required	361814

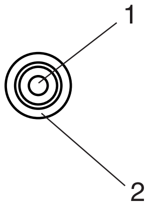
Example of Wrapping

NOTE

Attach and fix the ferrite core near the connector of the cable that connects to the cardiograph.



EXT-IN 1, 2 Connector



Using connector: SG-8036 (Code No.: 273446)
Mating connector: P-112D 3.5mm φ miniature plug (Code No.: 606907)

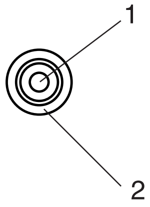
Pin No.	Signal
1	EXT-IN 1 or 2
2	GND

Input sensitivity: 10 mm/0.5 V,
Input impedance: 100 kΩ or more

CRO-OUT Connector

CAUTION

Do not use the output signal from the output connector for a synchronization signal such as the synchronized cardioversion signal. There is a time delay between the input ECG signal and output signal.

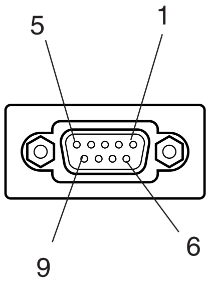


Using connector: SG-8036 (Code No.: 273446)
Mating connector: P-112D 3.5mm φ miniature plug (Code No.: 606907)

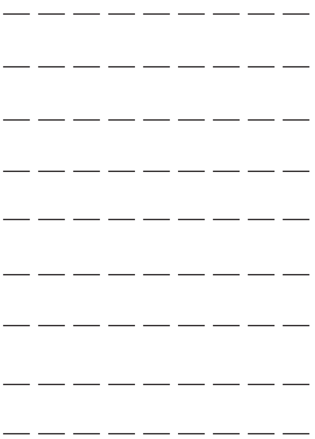
Pin No.	Signal
1	CRO-OUT (lead II)
2	GND

Output sensitivity: 0.5 V/1 mV

SIO Connector

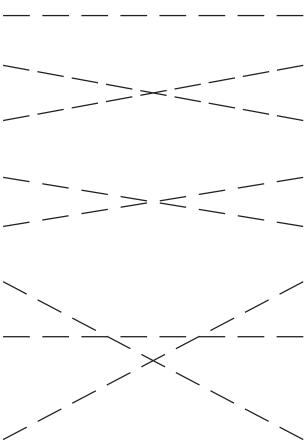


Output impedance: 100 Ω or less
Using connector: JEY-9S-1A2B (Code No.: 390774)
Mating connector: Connector DE-9P (Code No.: 082625)
Cover DE-C8-J9-F1-1 (Code No.: 336708)



Pin No.	**Signal**	**Pin No.**	**Modem**
1	Shield	1	Shield
2	TxD	2	SD
3	RxD	3	RD
4	RTS	4	RS
5	CTS	5	CS
6	DSR	6	DS
7	GND	7	SG
8	DCD	8	CD
9	DTR	20	ER
		9 to 19 and 21 to 25	Not used

Pin assignment may depend on the shape of connectors for modems.
To connect a modem, use a dedicated cable 15 m or shorter.



Pin No.	**Signal**	**Pin No.**	**IBM compatible personal computer**
1	Shield	1	Shield
2	TxD	2	TxD
3	RxD	3	RxD
4	RTS	4	RTS
5	CTS	5	CTS
6	DSR	6	DSR
7	GND	7	GND
8	Not used	8 to 19	Not used
9	DTR	20	DTR
		21 to 25	Not used

Pin assignment may depend on the shape of connectors for PCs.